Excavation and Embankment Inspection

Construction Inspector's Training Manual

January 2005

Washington State Department of Transportation

Excavation and Embankment Inspection

Construction Inspector's Training Manual

January 2005

Washington State Department of Transportation
Field Operations and Support Service Center
Construction Office

Contents

Contents

Part 1

Introduction

Course Information

Course Code: AC3

Class Number: _____

Date: _____

Location: _____

Instructor: _____

Goals of This Course

This course is designed to familiarize you as an earthwork and surfacing inspector in the following areas:

- The definitions of earthwork terms
- The importance of the excavation and embankment inspector
- The inspection duties
- The required tests and frequency
- How to complete the required documentation
- Why communication is important
- Basic safety requirements
- Roadway design elements
- Environmental BMP's

Importance of Roadway Excavation and Embankment Inspector

Present day earth-moving equipment and practices have accelerated grading operations. Project Engineers must make every effort to plan ahead and foresee conditions that may require changes. Delays in work progress are costly both to the department and to the contractor and must be avoided whenever possible.

The Excavation and Embankment Inspector plays a critical role in the success of the Project Engineer working proactively to minimize costs associated with changes and delays. You are the eyes and ears of the Project Engineer during every excavation and embankment operation on the project.

Part 2

Communication and Safety

Communication

Good two-way communication between the Contractor and the project inspection staff is key in the prevention of delays to the contract work. Along with daily communications with the Contractor, the project office should receive regular schedule updates from the contractor on work to be accomplished over the next week or two. The Earthwork Inspector should review the work schedule for upcoming inspection duties, missing material submittals, scheduling of material testing, and for work that may require the presence of other Department personnel like the Survey Crew. In an ideal world the contractor would always keep the inspector informed of future needs and change, but we all know that just doesn't happen. By looking ahead and thinking about what will happen next in the progression of work, the inspector may be able to help avoid unnecessary delays.

When materials are tested for acceptance and the test results are known, make certain that information is passed along to the contractor in a timely manner.Always keep your supervisor informed of the progress of the work, test results and of any communications you have with the contractor or other Department personnel.

Workzone Safety

Safety is the top priority of WSDOT. Roadside safety addresses the area outside of the roadway. (Workzone safety addresses areas within the limits of the project). While safety of vehicle occupants is a major consideration in roadside design, the safety of personnel working on the roadway or along the roadside is also a very critical consideration.

On every project personal safety is a major concern, not only for State & Contractor's employees but for the traveling public as well.

Traffic Control

To move traffic safely and efficiently through and around the workzone the contractor must work from an approved traffic control plan. The inspectors need to familiarize themselves with the traffic control plan and contract specifications to ensure traffic is moved through the project safely and with a minimum of delay.

Also, whenever working around traffic always make every effort to face the oncoming vehicles.

Personal Protective Equipment

Keep yourself visible to traffic and the contractor's workforce by wearing your hard hat and vest, and high visibility apparel must be worn at night. But don't stop there; ensure your personal long-term health by wearing protective footwear, hearing protection when working around loud equipment, and eye protection when working around operations that kick up debris. The Department will provide the personal protective equipment you need to do your job safely.

Contractor's Equipment

When coming onto the jobsite keep a watchful eye on the contractors operation and observe where it is safe for you to travel or park. A lot of the equipment used in construction is large and fast with poor visibility, and it only take a moment for a scraper to back over the top of you or your vehicle. Also, listen for the backup alarms on the contractor's equipment, if they are not working tell the contractor to get the alarm fixed or have the equipment removed from the project (see WAC 296 155 610(d)). A recent change to the WAC now requires dump trucks, when backing into a work area, to not backup until an observer signals that it is safe to back.

During nonworking hours equipment or materials shall not be within the construction safety zone unless it is protected by permanent guardrail or temporary concrete barrier. The construction safety zone is determined by posted speed limit and is measured from the edge of traveled way.

MPH	Distance (ft)
35	10
40-55	15
60	30

State Vehicles

Keep your state vehicle clean and in good repair. Don't allow problems with the equipment like the lights, wipers blades, or roto-beam to continue, take the time to get the equipment into the shop for repair.

Nuclear Density Gauges

Safe use of the Nuclear Density Gauge is essential on the construction site. To ensure the safety of the user and the public, all inspectors are required to attend and pass the Nuclear Density Gauge Safety and Operations class before they are allowed to transport and operate the density gauge.

All users of the gauge will also be monitored for radiation exposure by wearing a Thermal Luminescent Dosimeter (TLD) badge when operating the gauge. Any unmonitored person must stay at least 15 feet away from the gauge when it is in use.

Security of the gauge must also be maintained whenever the gauge is removed from storage. When the gauge is brought out to the jobsite, the gauge must be kept in direct control of the operator or locked inside of the operator's vehicle when not in use.

Hazardous Materials

Hazardous materials including spills from the contractor's equipment must be properly handled to avoid any unnecessary spread of the contamination. Any known hazardous materials site must be delineated and avoided until properly cleaned up. When working the excavation site always be on alert for unrecognizable materials or odors and don't allow the excavation to continue until you can get someone on site to determine how to proceed.

The Contractor is also required to prepare project specific spill prevention, control and countermeasures (SPCC) plan for the duration of the project. A spill prevention kits should also be a standard piece of equipment in all State vehicles.

Part 3

Earthwork Components

Clearing and Grubbing (Standard Specifications 2-01)

Clearing and grubbing is the removal and disposing of unwanted material such as trees and brush within the roadway prism. Grubbing is the removal and disposal of unwanted vegetation within the roadway prism.

Be aware that there are conditions as to the amount of grubbed area that is allowed to open to erosion.

Removal of structures and obstructions (Standard Specifications 2-02)

This work includes the removal and disposal of, or salvaging of materials that are named in the Special Provisions. As an example this may include the removal of existing foundation of homes. The Standard Specifications outline the requirements for removal.

Roadway Excavation or Embankment (Standard Specification 2-03)

Excavation requires the removal of material that may be used for embankment construction or may be removed because the material is unsuitable for roadbed construction.

Embankment is the building up of the roadbed in layers using native or select material that is imported to the jobsite.

Borrow (Standard Specification 2-03)

Borrow is the excavation of material outside the roadway prism or outside the limits of any other excavation area required by the contract. Before any borrow site can be used, it must be measured and approved by the Engineer.

Waste (Standard Specification 2-03)

If the Contracting Agency provides no waste site, but requires disposal of excess excavation or other materials, the Contractor shall provide the Engineer the location of all disposal sites to be used and also provide copies of the permits and approvals for such disposal sites before any waste is hauled off the project.

Haul (Standard Specifications 2-04)

This work consists of transporting excavated material from its original site to its final place in the work. Haul is sometimes a pay item that will be listed in the Special Provisions and Contract Plans.

Subgrade Preparation (Standard Specifications 2-06)

This work requires the finish grading by a grader to bring the final subgrade or surfacing materials to the final plan elevation.

Watering (Standard Specifications 2-07)

During the construction of the embankment and finishing of the subgrade the contractor will add water to help in achieving the required compaction during construction. It is also important that the contractor uses water for control of jobsite dust.

Trimming and Cleanup (Standard Specifications 2-11)

Upon completion of the roadway the contractor is required to finish the roadway area in such a way the area will have a pleasing appearance. This work includes but not limited to cleaning of ditches and channels and removal of loose rock on the roadway.

Construction Geotextile (Standard Specifications 2-12)

During construction soft areas within the roadway prism may be encountered. To help the natural soils to support the new roadbed a cloth material may be placed over the native material and then the roadbed can be constructed.

Part 4

Inspector Preparation

In preparation for the upcoming project, become familiar with:

Contract Plans and Documents

Hierarchy of Documents

List in order of precedence

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

Construction Manual

Review “Earthwork” Chapter 2, “Bases” Chapter 4, and “Materials” Chapter 9.

Field Data

Grade books

Staking data

Equipment

As earthwork inspector, you will need the following equipment.

- Stick Rule
- Tape Measure
- Rag Tape
- Spray Paint
- Screw Driver
- Hand Level
- Lath
- Guard Stakes

Materials

Obtain Documentation

- ROM (Record of Materials)
- Approval of sources

  RAM (Request for Approval of Materials)
  QPL (Qualified Products List)

Obtain Preliminary Samples

- Job site soils for density determination
- Materials

Disposition of Waste Material

- Is there a state provided waste site or is the contractor required to provide a waste site?
- Any wasting of material, setup by the Contractor onto a private land, should include the receipt of written approval from the property owner. This letter should include at statement that the property owner is taking full responsibility and ownership of the material and that no wetlands are being destroyed. **But don't stop there, always check with your Region's Environmental section for advice and review of any changes to the contract's waste or borrow sites.**

Other Contract Documents

- Request to sublet work
- Permits as required
- Progress schedule

Quantity Details

The number of significant decimal places to which quantities should be measured and/or computed varies with the value or unit bide price of the item. Unless advised otherwise, the Project Engineer should use the following guidelines.

Bid Price	Significant Decimal Per Unit
Less than $10 per unit	1.
From $10 to $100 per unit	0.1
Over $100 per unit	0.01

Part 5

Environmental

Sensitive or Critical Areas

Some areas have been given special designation by local, state, or federal agencies and require special consideration because of environmental determinations. Sensitive areas (also called critical areas) such as sites with endangered plant and animal species, and designated lands such as wetlands, require special consideration during construction activities. Wetlands, streams, and wildlife habitat are sensitive areas.

Primary Considerations

Emphasize sensitive areas during pre-contract meetings.

- Note activities that are not allowed in the sensitive areas and designated lands (such as clearing, grading, stockpiling materials, construction equipment, vehicle parking, etc.)

Install construction fencing or flagging to protect sensitive areas from encroachment by construction activities, if appropriate.

Erosion control can be a significant issue in sensitive areas.

Timing Restrictions

Timing restrictions due to the presence of threatened and endangered species relate to the sensitive portions of their life cycle. Sensitive times include winter periods, migratory periods, and breeding seasons. Adjustments might be possible depending on site specific use.

Wetlands

Wetlands are highly protected by law. Federal, state, and local laws, and departmental policies require WSDOT to operate with “no net loss” of wetland function or acreage.

Why Protect Wetlands?

- Flood Protection
- Water quality
- Habitat
- Recharging of aquifers
- Recreation

Prior to Project

- During the pre-contract period, the Project Engineer should obtain copies of the final EIS and any special environmental studies related to the project.
- Obtain copy a of wetland permit.
- Verify that all wetlands are delineated on all contract plans.
- Identify and mark out wetlands on project.
- Make sure prime the contractor is aware of wetland locations.
- When in doubt, notify your supervisor or Environmental Office at your regional office.
- Review and be familiar with Best Management Practices (BMPs) for construction sites in the *Highway Runoff Manual*.
- Review and be familiar with Stormwater Site Plan.
    - This plan shows measures that will be taken during and after project construction that addresses erosion and sediment control and stormwater runoff. Refer the *Highway Runoff Manual* for contents of Stormwater Site Plan.
- Review and be familiar with TESC (Temporary Erosion and Sediment Control Plan).
    - Contractor may submit a revised TESC Plan for approval before work begins.
    - Must have PE approval on revised TESC plan before work begins.
    - Review General Special Provisions for Erosion and Sediment Control (ESC) Lead. This GSP describes the qualifications and responsibilities of the Erosion Control Lead.

      Since 1997, certified Erosion Control Leads have been required on all WSDOT projects with TESC plans, which include all projects involving earthwork. Earthwork includes excavation, clearing, grubbing, trenching, or any other activity that exposes bare soil to precipitation or wind.
    - Review *Standard Specification* 8-01

Erosion and Water Pollution Control (8-01 Standard Specifications)

- Clearing and grubbing
    - Limits listed in Section 8-01.3 (1) of the Standard Specifications
    - Any changes to limits requires written approval of the Engineer

- Temporary Erosion and Sediment Control (TESC) Plan (8-01.3(1)A)
    - Requires Engineer's written approval before work begins
    - The Contractor shall revise and update upon the written request of Engineer

- Contractor shall allow five working days for review of any new or updated plan

- Erosion and Sediment Control (ESC)Lead (8-01.3(1)B)
  - Required for all projects
  - Must be identified by the contractor prior to starting work
  - Must have a current Certificate of Training in Construction Site Erosion and Sediment Control from a course approved by WSDOT

- The ESC Lead shall inspect all on-site erosion and sediment control measures
  - At least once every five working days
  - Within 24 hrs of a runoff producing rain event
  - Each working day during a runoff producing rain event

- TESC Inspection Report
  - A copy of the report shall be provided to the Engineer
  - Items required in the report are listed in Section 8-01.3(1)B of the Standard Specifications
- Inspectors can use the form 351-100EF as a guide during their evaluation of the TESC Plan's current effectiveness (A copy of this form can be found in Appendix B.)

During Construction

- Follow details outlined in contract plans and special provisions.
- Make sure prime contractor and subcontractors are aware of wetland locations.
- Check that waste material is being disposed of properly.
- Verify that staging areas and maintenance areas are outside wetland areas.
- Minimize soil compaction in wetland mitigation construction area by minimizing the amount of time equipment is operating in the area.
- Flag existing wetlands that are not to be disturbed by using construction fencing to keep construction equipment out of the area.
- Check that temporary water pollution control and erosion control systems are properly installed and maintained. In the fall months, prior to the "rainy season" or a winter shutdown, the Project Engineer must schedule an on-site review of the project with the contractor for the specific purpose of identifying appropriate erosion prevention measures which will reduce and minimize the potential for erosion during the winter months.
  - TESC plan should be updated as work progresses.
  - Always keep a copy of the TESC plan on site (permit requirement).
  - What if there is a violation? Corps of Engineers will do an on-site review.

Part 6

Construction

Project Control and Staking

Surveying Provided by the State — Unless the contract states otherwise, the Project Engineer is responsible for providing all surveying needed to locate and define the contract work.

Contractor Surveying — If the contract requires the Contractor to provide some or all of the construction surveying, the Project Engineer is required to provide only the primary control points staked, marked, and verified in the field.

Points that are laid in the field are:

Centerline

Right of Way

Easements — New and Existing

- Permanent — of record
- Temporary — for construction use

Clearing and Grubbing Limits

Removal of Structures and Obstructions

- Utility relocations
  - Water
  - Sewer
  - Gas
  - Telephone
  - Power

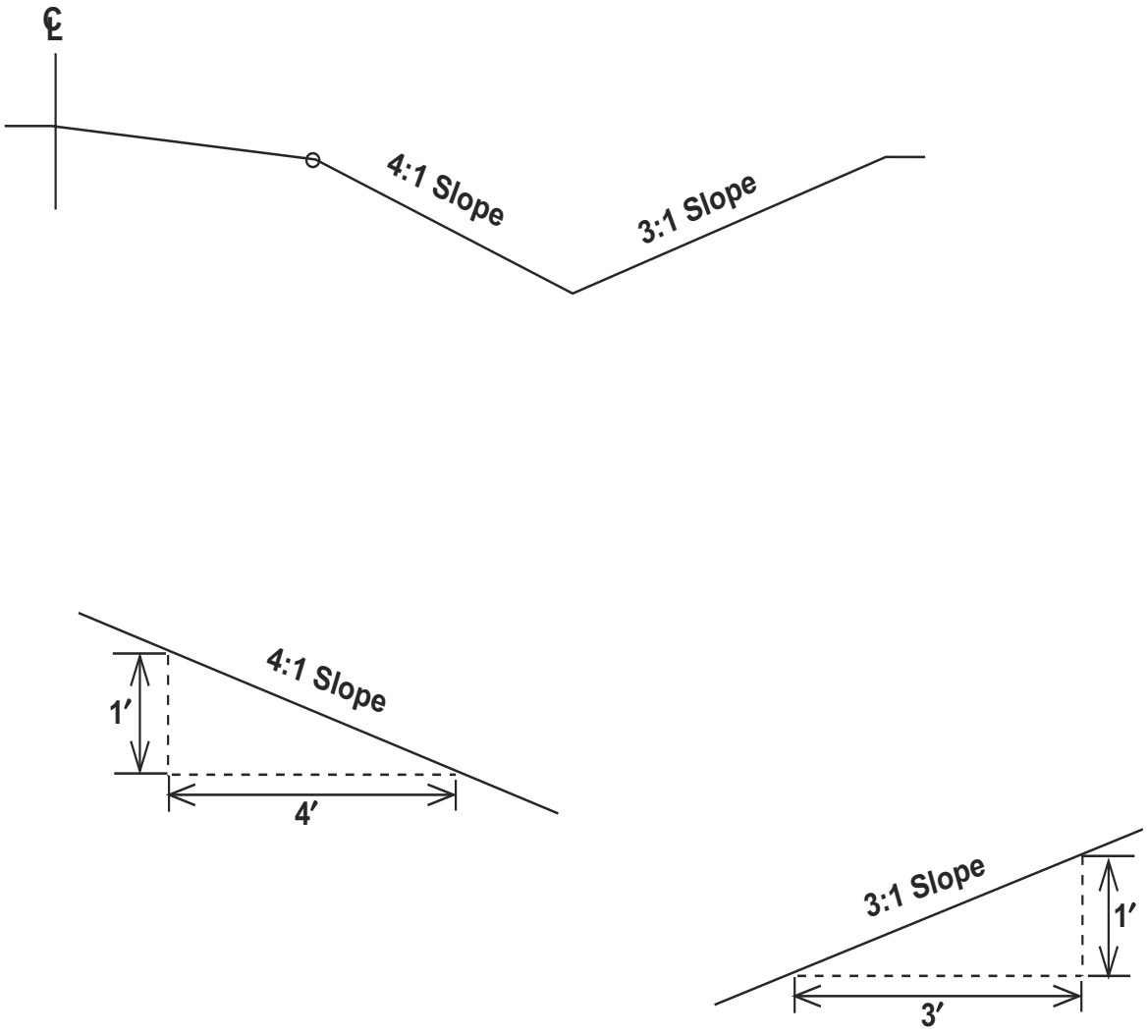
Horizontal (I.E., PC,PT,POC)

- Vertical Controls (Elevations)

Slope Stakes

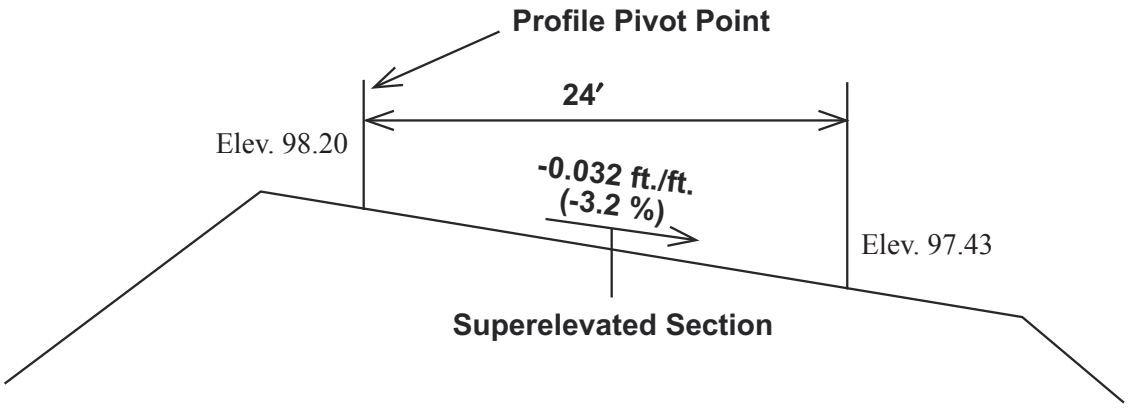
- Earth cuts
- Embankment

Slopes



English 4:1 slope is 4 feet horizontal, 1 foot vertical

Cross Slopes



Cross Slope (English)

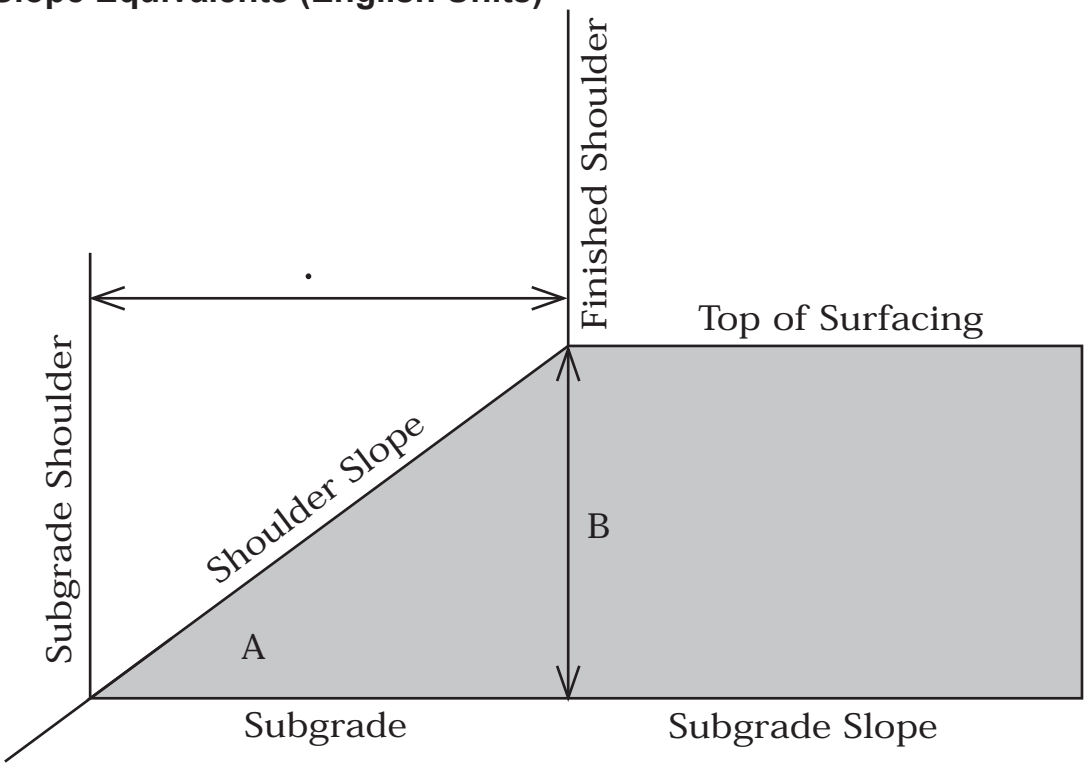
$$\frac{\text{Vertical Distance (ft)}}{\text{Horizontal Distance (ft)}} \text{ x } = \text{ ft/ft Slope}$$

Example:

98.20 - 97.43 = 0.77

$$\frac{0.77}{24} = -0.032\text{ft/ft}$$

Determination of Distance From Finished Shoulder to Subgrade Shoulder and Slope Equivalents (English Units)



Equation: $X = \frac{100\ (B)}{A}$

A = Algebraic difference in percent between shoulder slope and subgrade slope

B = Depth of surfacing at finished shoulder in tenth's of a foot

X = Distance from finished shoulder to subgrade shoulder in feet

Shoulder Slope	Equivalent Rate of Grade	Equivalent Vertical Angle
1.5:1	66.67%	33° 41.4′
1.75:1	57.14%	29° 44.7′
2:1	50.00%	26° 33.9′
2.5:1	40.00%	21° 48.1′
3:1	33.33%	18° 26.1′
4:1	25.00%	14° 02.2′
5:1	20.00%	11° 18.6′
6:1	16.67%	9° 27.7′
8:1	12.50%	7° 07.5′
10:1	10.00%	5° 42.6′

Subgrade Slope	Equivalent Rate of Grade	Equivalent Vertical Angle
.02/1	2.00%	1° 08.7′
.025/1	2.50%	1° 25.9′
.03/1	3.00%	1° 43.1′
.035/1	3.50%	2° 00.3′
.04/1	4.00%	2° 17.4′
.05/1	5.00%	2° 51.7′

Calculating Subgrade Width

Sample Problem

You need to check the subgrade width on the right at station 151+56 the plans show a finished roadway width of 20 feet and the total surfacing depth of 1.05 feet. The end slope is 4:1 and the cross slope is –0.02 foot per foot. The subgrade width of the roadway on the right side would be what?

Equation: $X = \frac{100\ (B)}{A}$

Given:

Surfacing Depth (B) = 1.05 feet

End Slope = 4:1 = 25%

Cross Slope = -0.02 feet = -2%

Finish road width = 20 feet

$X = \frac{100\ (1.05)}{25 - 2} = \frac{105}{23} = 4.57$ feet.

Finish Subgrade width would be; 20 + 4.57 = 24.57 feet

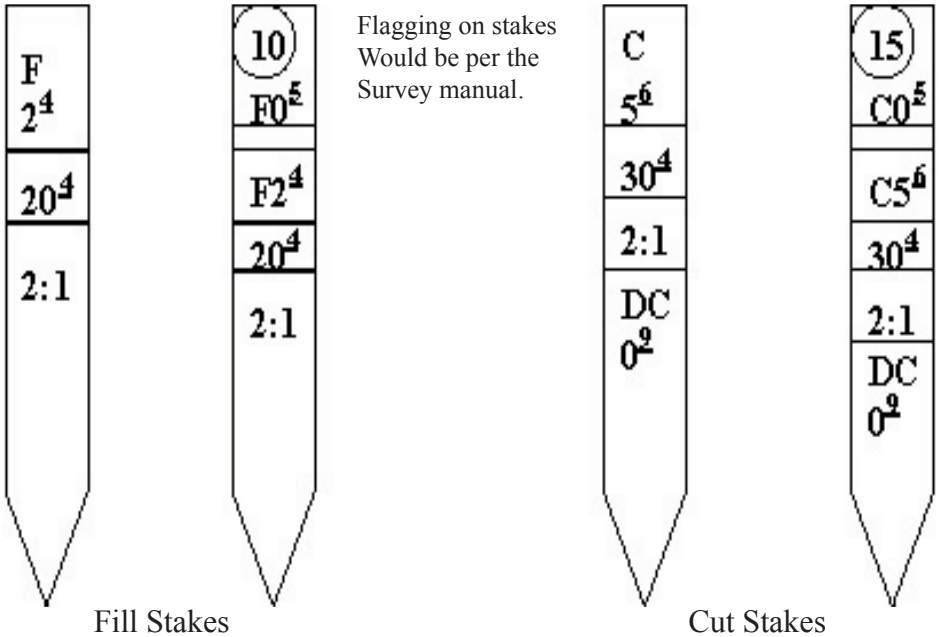
Exercise

The contractor comes up to you and says that the roadway width at station 147+90 appears to be to narrow on the left but the grade run doesn't give you the subgrade width at that odd station. From the paving plans you note that the finished roadway width is 18.5 feet. The end slope is a 2:1 and the cross slope of the roadway from the roadway profile sheet is a +0.04 foot per foot. The cross section in the contract plans show a total surfacing depth of 1.75 feet. What should the subgrade width be on the left at station 147+90?

Slope Staking

Slope stakes are used to determine the location where the new embankment or the top of a cut section intersects natural ground known as the catch-point (figure two on page ?). The survey crew will write on the slope stake the following information;

- The vertical cut or fill height.
- The end slope, i.e. 2:1, 3:1
- The horizontal distance from a known reference line, such as centerline of road.
- The amount of ditch cut (DC) that is required through a cut section.



Fill Stakes

Back side of stake has station

Cut Stakes

Back of stake has station

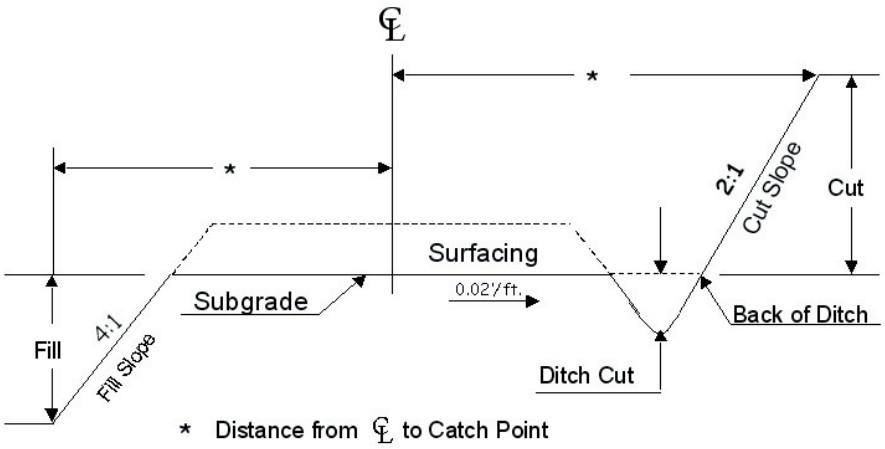


Figure 1

Figure 1 shows the relationship of the cut or fill catch point to centerline and subgrade.

The survey crew will also place a reference-offset hub along with an offset stake. This stake will have the offset distance from the catch-point to the offset hub. The stake will also will give you the cut or fill from the hub to the catch-point stake. Along with this information the survey crew will write the same information that was listed on the catch-point stake.

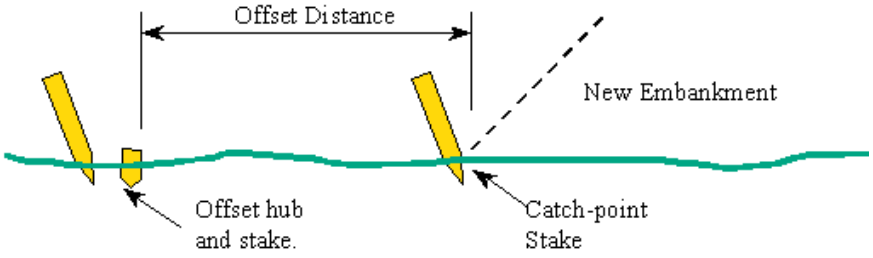


Figure 2

It is always suggested that you check with the survey crew who did the staking to verify how you should read the slope stake. Though we try to be consistent sometimes-different survey crews write the stakes differently.

The stake shown in this picture is at the catch-point of a Fill slope. This stake provides the information needed by the inspector and the contractor's stake hop to construct the side slope up to the new roadbed.

Checking End Slopes

The reference material and equipment that the inspector will need to perform side slope checks and to verify that the cut or fill has been constructed to the correct elevation are;

- Contract Plans
- Template elevation listing (a.k.a. grade run)
- Slope Stake data (in case you can't read the stake)
- Rag Tape
- Stick Rule
- Hand level (a.k.a. P Gun)
- H.I. stake marked in one-foot increments

To check the end slope construction the inspector takes the H.I. Stake along with the hand level and locates a point on the end slope that is level. If the inspector was holding the hand level at 3 feet above the bottom of the stake and the slope was on a 2:1 then the point that was sighted should be 6 feet away (3 x 2 = 6 See figure 2 and 3). If the point was closer then 6 feet then the slope was too steep, if the point was further away then the slope was too flat.

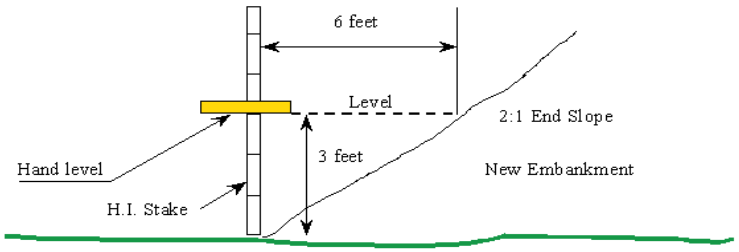


Figure 3

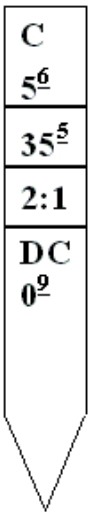
Figure 4
Here the inspector is checking the vertical distance between the catch-point and a point set by the contractor. By knowing the vertical distance and the propose slope (i.e. 2:1) the inspector can now verify if the slope is built correctly. Note the stick rule for checking distance

Verification of slope construction is not required to be performed at every station. Spot checks through out the project are sufficient.

Determining Distance to Subgrade Shoulder

Using a combination of the roadway template (grade run) and the slope stake information you can determine the distance from the catch-point to the Subgrade shoulder. From the roadway template you need to know the distance from centerline to Subgrade shoulder for fill slopes. For subgrades going through cut sections you need to know the distance from centerline to the back of ditch. By taking the distance on the slope stake and subtracting out the template distance you will have the distance from catch-point to subgrade shoulder or the back of ditch.

Example: The distance from centerline to the back of ditch is 24.32 feet and the slope stake at the catch-point has the following information.



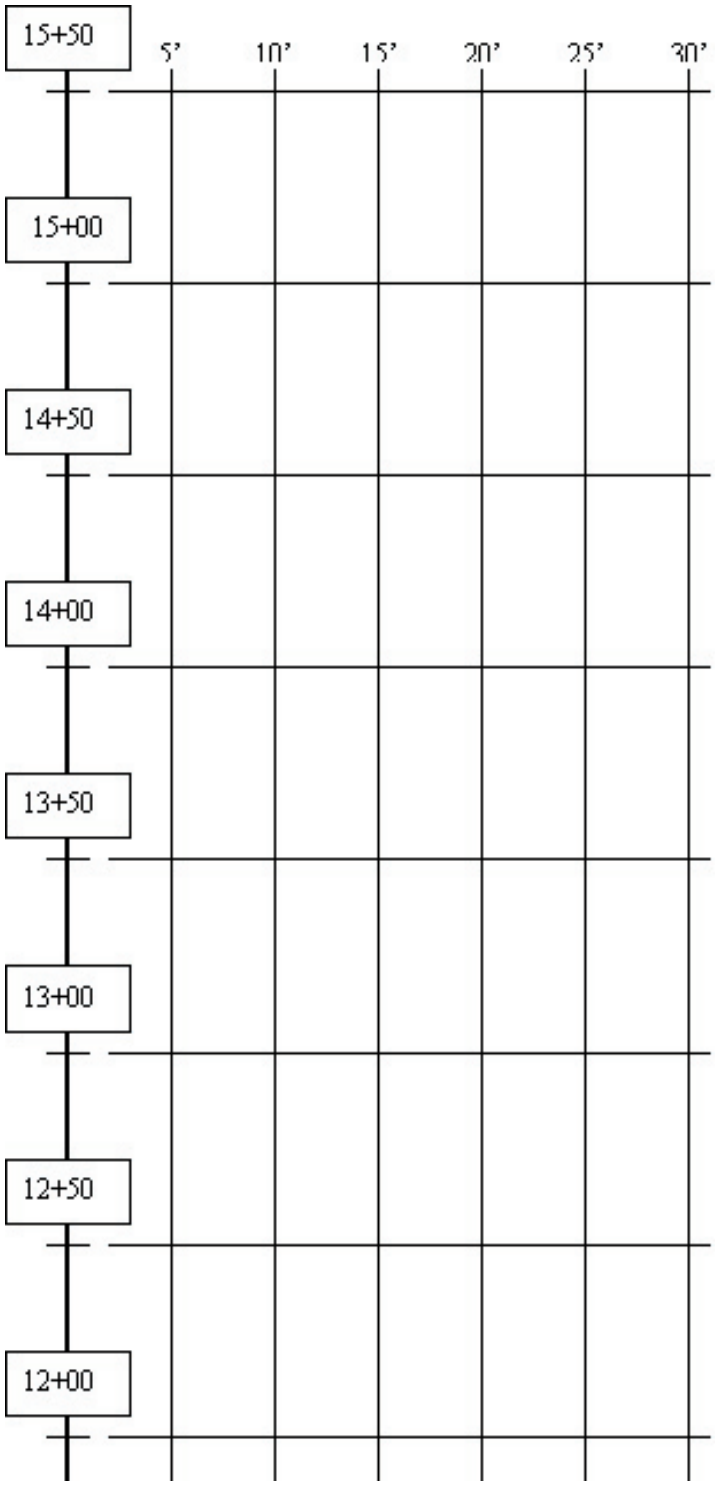
So the distance from the catch-point to back of ditch would be;

35.5 – 24.3 = 11.2 feet

Slope Staking Exercise

Below are slope stakes for various stations along a new roadway. Some stakes are missing and others may have incorrect information. Using the information on the stakes and offset stakes plot the catch points and where subgrade shoulder would be. On the next page a grid is available for your use.

Station	**Right Slope Stake**	**Right Offset**
15+00	F2.0 / 2:1/ 13.0	10’ F0.2// F2.0 / 2:1 / 13.0
14+50	F 4.9 / 2:1 / 18.8	10’ C 0.3 // F4.9 / 2:1/ 18.8
14+00		10’ F0.2 // F8.5 / 2:1 / 26.0
13+50	F 7.0 / 4:1 / 23.0	10’ F 0.4 // F7.0 / 4:1/ 23.0
13+00	F 6.7 / 2:1 / 25.4	10’ C 0.1 // F6.7 / 2:1/ 22.4
12+50	F3.1 / 2:1 / 15.2	10’ F0.3 // F3.1 / 2:1 / 15.2


15+50
5'
10'
15'
20'
25'
30'
15+00
14+50
14+00
13+50
13+00
12+50
12+00

Grading Staking

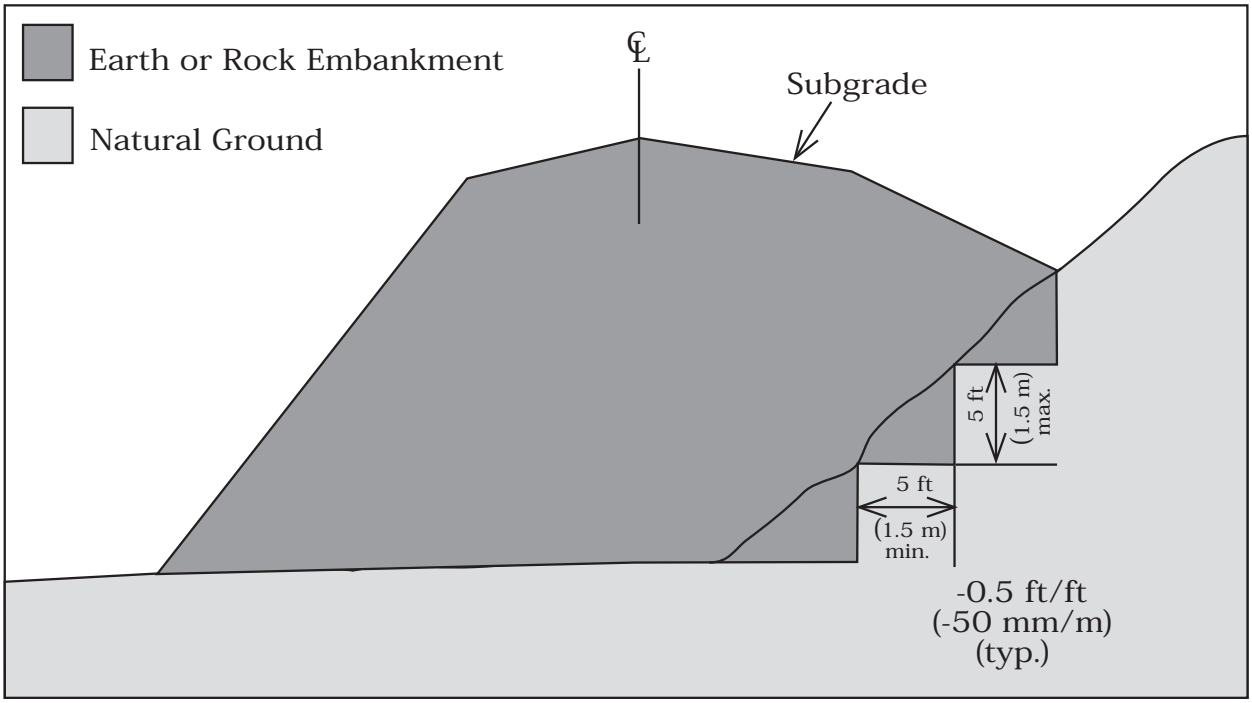
Once the contractor has got the initial subgrade completed the survey crew will come in and set grade hubs at various points along and across the roadbed. In most cases the hubs are set at centerline and at lane lines at 50-foot stations, sometimes closer through curves. This keeps the hubs close enough together across the roadway so that the finish grader's blade can be set over the hubs.

The hubs for subgrade are known as "Blue Tops" (figure 5) and will be set 0.05 foot lower then the plan elevation. This is done to prevent the blue tops from being pull out of the ground by the grader during construction plus upon completion of the subgrade the contractor is allowed a tolerance of –0.05 foot lower then plan.

Figure 5;
This shows a subgrade blue top set .05 foot low. Since the hub cannot be seen the contractor places on top of the hub what are called feathers.

Hillside Terraces

Standard Specification 2-03.3(14)

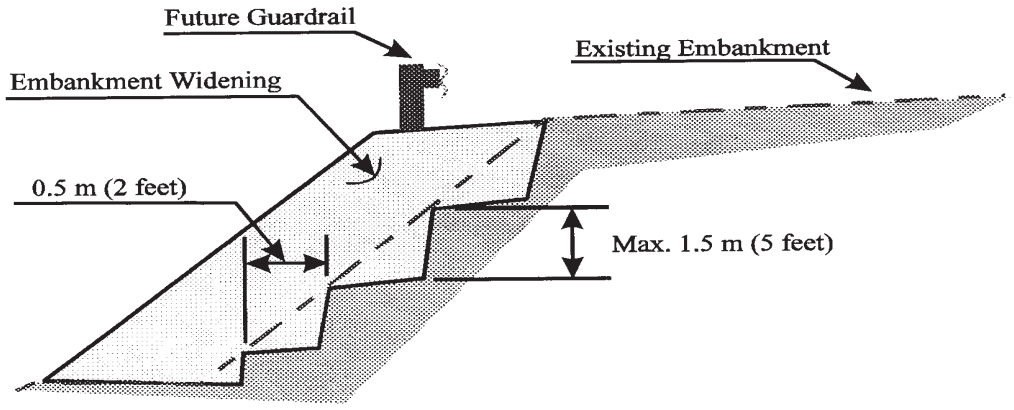


Requirements

Item	Required	Std. Spec. Ref.
Application	Unless the engineer directs otherwise, the contractor shall place hillside terraces: 1. On hillsides 2. On the sides of existing embankments 3. In transitions from cuts to fills	2-03.3(14)

Other references: *Construction Manual* 2-3.1D

Widening for Guardrail



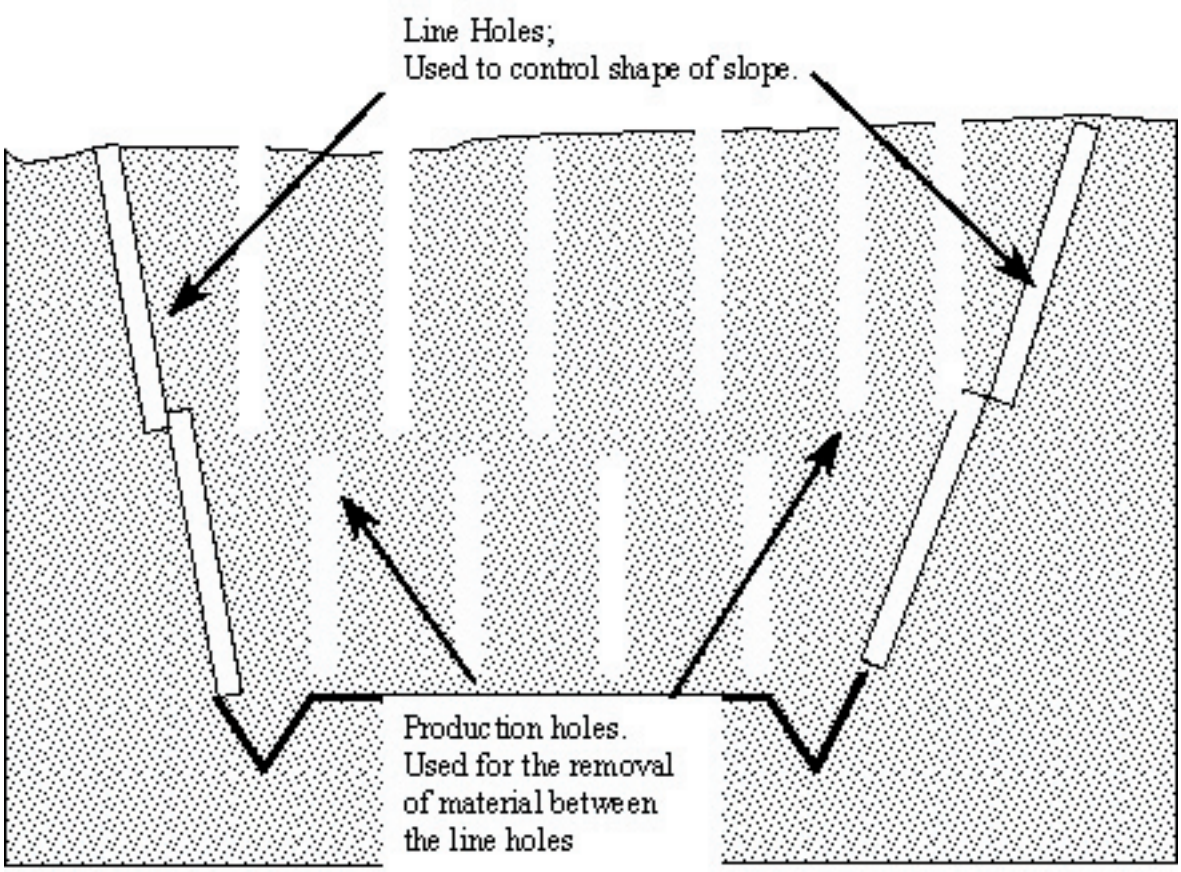
Inspection Activities

Document Clearing and Grubbing

- Contact landscape architect (Regional Environmental area) when vegetation should be saved.
- Provide clearing and grubbing for slope treatment.

Monitor Settlement Indicating Devices

Check Terracing of Existing Slopes and/or New Cuts, Standard Specification 2-03.3(14)



Cross Section of Controlled Blasting area

Controlled Blasting (Std. Spec. 2-03.3(2))

Prior to blasting the contractor must submit a blasting plan to the engineer for review Section 2-03.3(2) of the Standard Specifications list the requirements.

The contractor will drill holes in the location of the proposed side slopes these holes are called the line holes. If the depth of the cut is over 20 feet then the contractor will have to stage the blasting in layers (unless otherwise approved). Once the line holes have been blasted then the contractor will blast between those holes using what are commonly called production holes. Those holes are used to remove the remainder of the material.

Controlled blasting refers to the controlled use of explosives and blasting accessories in carefully spaced and aligned drill holes to provide a free surface or shear plane in rock along the specified backslope.

Inspection Activities

Monitor Cuts for Change in Materials

- Wet or unstable
- Select materials

Inspect Slope Construction and Rounding

- Observe the first slope rounding for approval, see Standard Plan H-8
- Inspect side slope compaction

Check Excavation of Cut to Fill Areas

- Wet or unstable

Check Moisture Content

- Requirements for Compaction Methods A, B, C
- If borrow material is being paid by the ton, weight deduction may be required if the material delivered is too wet. So, occasional moisture checks of the delivered material may be necessary.

Document Aeration When Used

- Contracting agency source
- Contractor source

Check on Placement of Construction Fabric, Sand Drainage Blanket, or Other Special Features in the Contract

Monitor Lift Thickness

Check Routing of Haul Equipment

Check That Any Wasting is Done According to the Contract Provisions

Check Finishing of the Subgrade

- Subgrade has been approved prior to placing surfacing
- Subgrade bluetops set at .05 feet below subgrade elevation and are accurate to .01 feet. Finish grade no higher than 0.00 feet above plan elevation, or lower than 0.05 feet
- Subgrade checked with rod and level or stringline
- Subgrade is compacted to proper density and is free of bumps, depressions, and soft areas
- Any problems in subgrade are documented and supervisor notified
- Solutions to subgrade deficiencies are documented
    - French drains
    - Digouts
    - Construction fabric

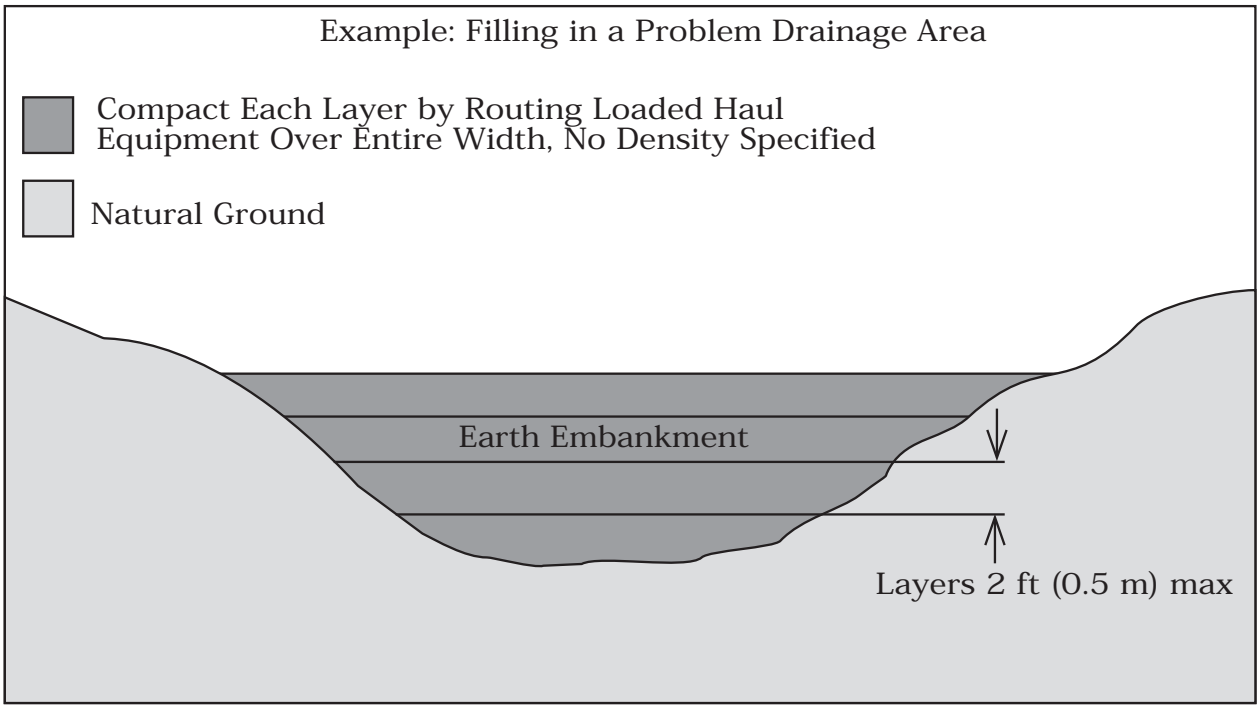
Check that all Widenings and Tapers Have Been Constructed

- Curb and guardrail

Check That Compaction is Done and Monitored According to the Proper Method

Earth Embankment: Method A Compaction

Standard Specification 2-03.3(14)C



Requirements

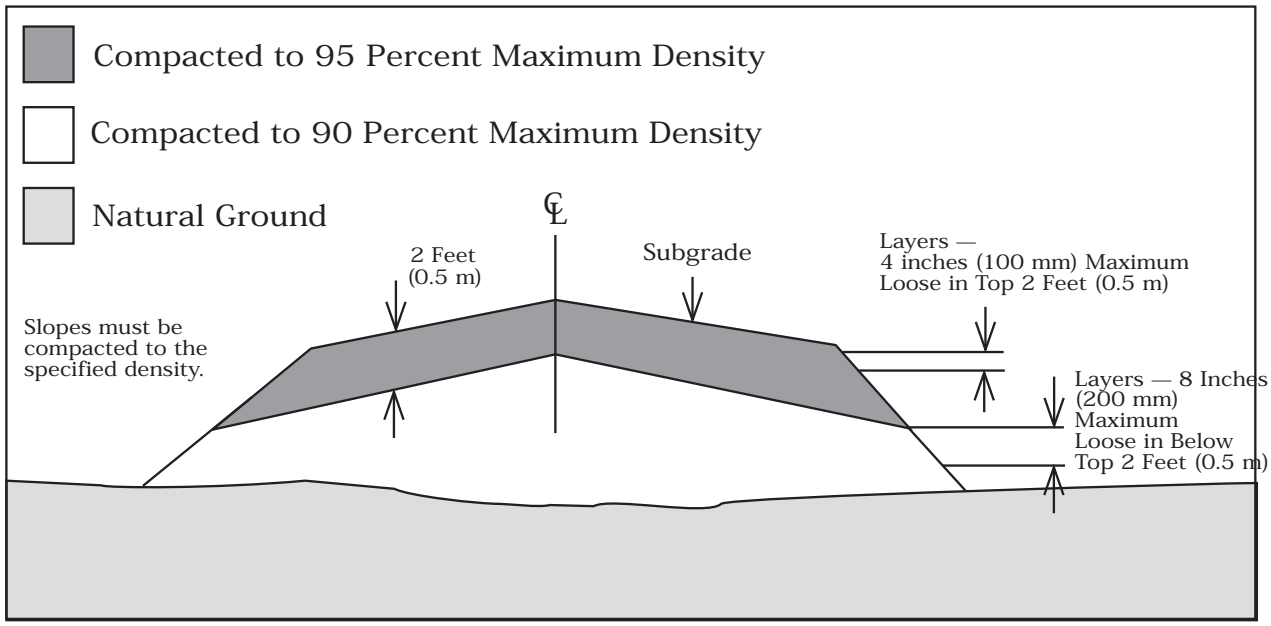
Item	Required	Std. Spec. Ref.
Application	Method A Compaction is used only where specified.	2-03.3(14)C
Compaction	Route loaded haul equipment over entire width for each layer. No density specified.	2-03.3(14)C
Moisture	No requirements.*	2-03.3(14)C
Lift Thickness	2 feet maximum.	2-03.3(14)C
Allowable Comp. Equipment	The contractor may compact with any type of hauling equipment approved by the engineer.	
Test Frequency	Visual inspection.	

Other references: *Standard Specification* 2-03.3(14)B, *Construction Manual* 2-3.2A, *Construction Manual* 2-3.2C

* The engineer may permit higher moisture. See *Standard Specification* 2-03.3(14)C for conditions.

Earth Embankment: Method B Compaction

Standard Specification 2-03.3(14)C



Requirements

Item	Required	Std. Spec. Ref.
Application	Method B Compaction is always used unless the Special Provisions require another method.	2-03.3(14)C
Compaction	95 percent — top 2 feet 90 percent — below top 2 feet	2-03.3(14)C
Moisture	Shall not exceed 3 percent above optimum for material passing U.S. No. 4 sieve.*	2-03.3(14)C
Lift Thickness	Top 2 feet (0.5 m) - 4 inches maximum loose. Below top 2 feet - 8 inches (200 mm) maximum loose.**	2-03.3(14)C
Allowable Comp. Equipment	Any equipment approved by the engineer.	2-03.3(14)C
Test Frequency	One density and one moisture every 2,500 CY.	9-5.7 (*Construction Manual*)

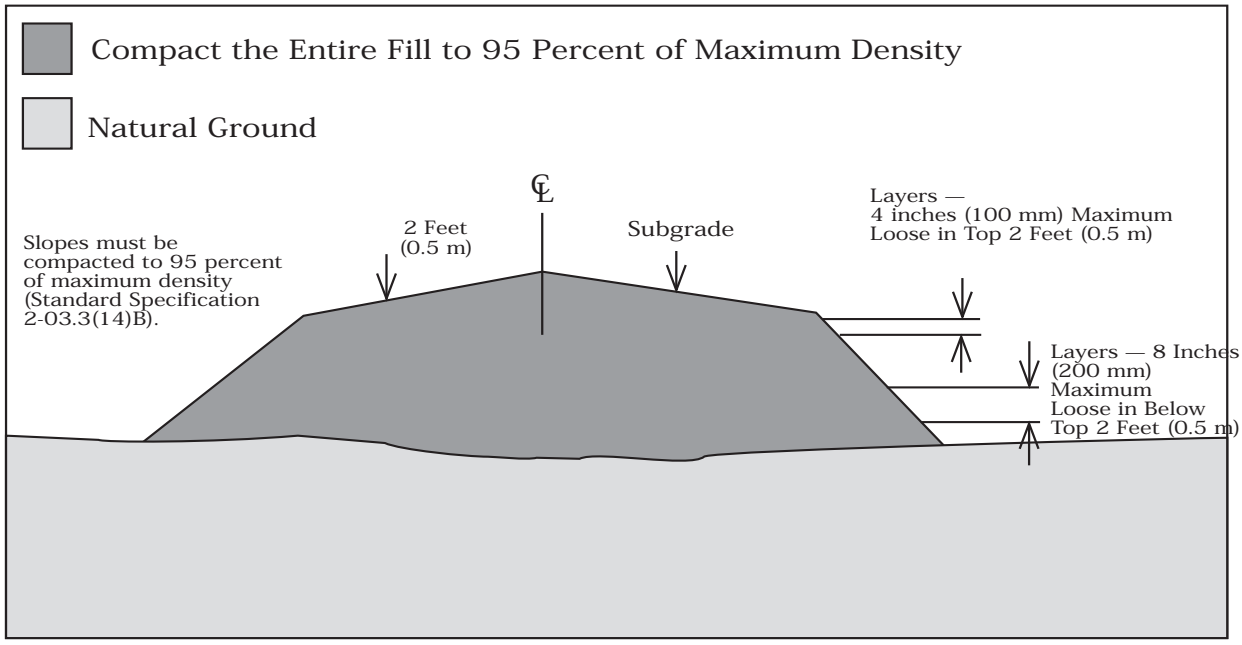
Other references: *Standard Specification* 2-03.3(14)B, *Construction Manual* 2-3.2A, *Construction Manual* 2-3.2C, *Construction Manual Chapter 9*, WSDOT FOP AASHTO T-310.

* The engineer may permit higher moisture. See *Standard Specification* 2-03.3(14)C for conditions.

** The engineer may permit thicker layers. See *Standard Specification* 2-03.3(14)C for conditions.

Earth Embankment: Method C Compaction

Standard Specification 2-03.3(14)C



Requirements

Item	Required	Std. Spec. Ref.
Application	Method C Compaction is used only when specified.	2-03.3(14)C
Compaction	95 percent each layer.	
Moisture	Not to vary more than 3 percent above or below optimum for material passing U.S. No. 4 sieve.*	2-3.3(14)C
Lift Thickness	Top 2 feet - 4 inches maximum loose. Below top 2 feet - 8 inches maximum loose.**	2-03.3(14)C
Allowable Comp. Equipment	Any equipment approved by the engineer may be used.	2-03.3(14)C
Test Frequency	One density and one moisture every 2,500 CY .	9-5.7 (*Construction Manual*)

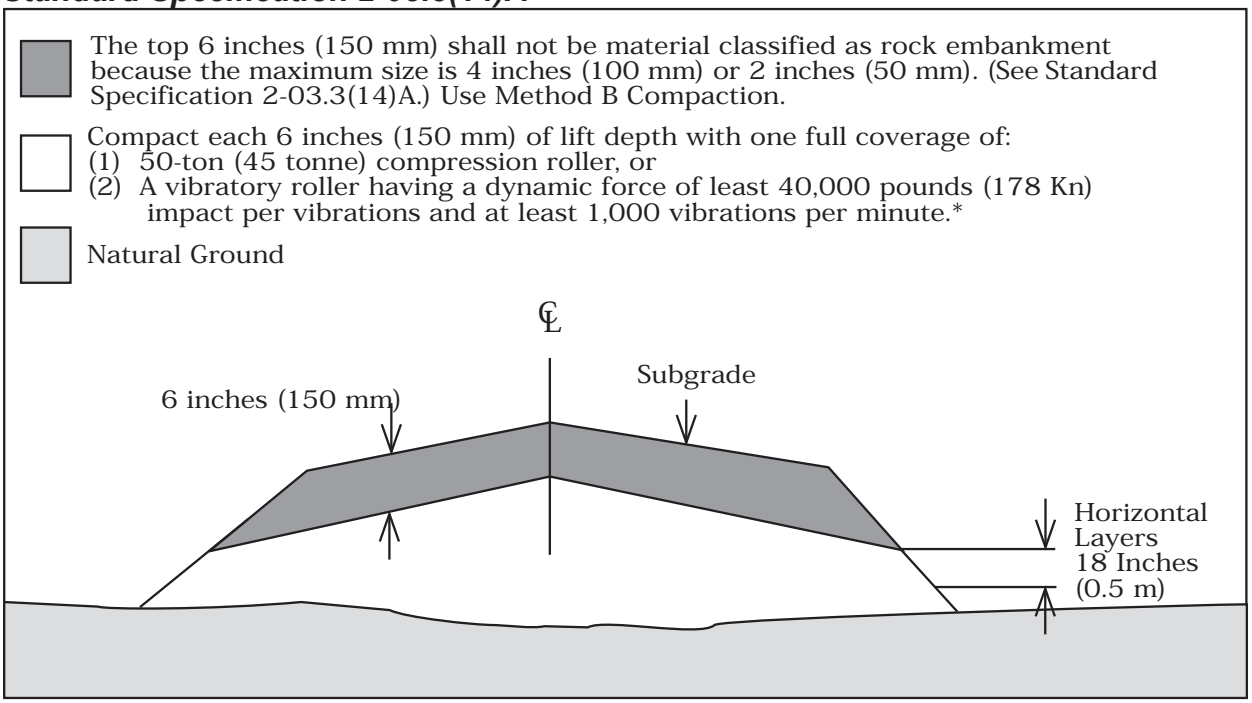
Other references: *Standard Specification* 2-03.3(14)B, *Standard Specification* 2-03.3(14)D, Construction Manual 2-3.2A, *Construction Manual Chapter 9*, WSDOT FOP AASHTO T-310.

* The engineer may permit higher moisture. See *Standard Specification* 2-03.3(14)C for conditions.

** The engineer may permit thicker layers. See *Standard Specification* 2-03.3(14)C for conditions.

Rock Embankment

Standard Specification 2-03.3(14)A



Requirements

Item	Required	Std. Spec. Ref.
Application	Any embankment which is defined as "Rock Embankment" See *Standard Specification* 2-03.3(14) for definition.	
Compaction	Compact each 6 inches of lift depth, or fraction thereof, with roller as noted above. In addition to rolling, the empty and loaded hauling equipment shall be routed evenly over the width of embankment, if possible.	2-03.3(14)A
Roller Speed	4 mph maximum for compression rollers, 1.5 mph maximum for vibratory rollers.	2-03.3(14)A
Test Frequency	Visual inspection.	

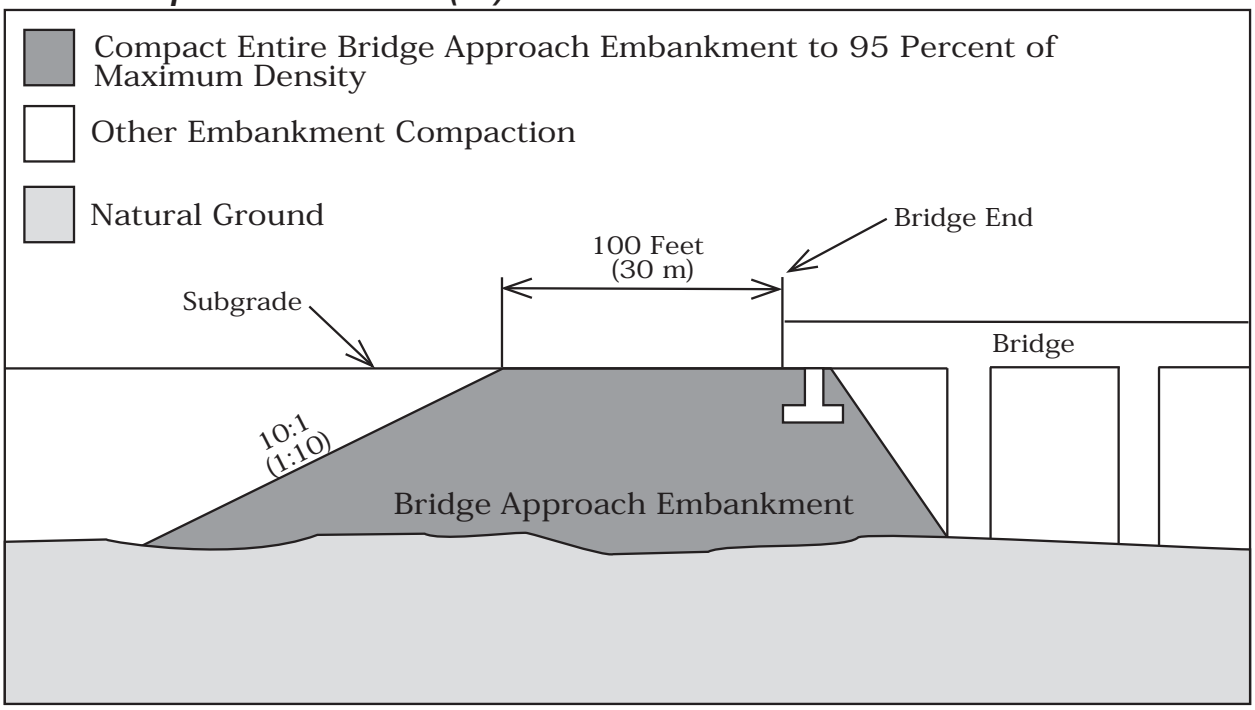
Other references: *Construction Manual* 2-3.2A and *Construction Manual* 2-3.2B.

* If depth is 18 inches or less, contractor may compact each 6 inches of lift depth with four full coverages with: (1) 10-ton compression roller or (2) a vibratory roller having a dynamic force of at least 30,000 pounds per vibration and at least 1,000 vibrations per minute (*Standard Specification* 2-03.(14)A).

** If rocks average more than 18 inches in diameter, then layers may be as deep as required to allow their placement (*Standard Specification* 2-03.3(14)A).

Bridge Approach Embankments

Standard Specification 2-03.3(14)I



Profile View

Requirements

Item	Required	Std. Spec. Ref.
Application	Embankments at all bridge and trestle ends.	2-03.3(14)I
Compaction	95 percent each layer.	2-03.3(14)I
Moisture	Less than 3 percent above optimum for material passing U.S. No. 4 sieve.*	2-03.3(14)C Method B
Lift Thickness	Top 2 feet - 4 inches maximum loose.Below top 2 feet - 8 inches maximum loose.**	2-03.3(14)C Method B
Allowable Comp. Equipment	Any equipment approved by the engineer may be used.	2-03.3(14)C
Frequency	One density and one moisture every 2,500 CY.	9-57 (*Construction Manual*)

Other references: *Standard Specification* 2-03.3(14)B, *Standard Specification* 2-03.3(14)D, *Standard Specification* 1-01.3, *Standard Plan* H-9, *Construction Manual* 2-3.2A, *Construction Manual* 2-3.2C, *Construction Manual* Chapter 9, WSDOT FOP AASHTO T-310.

* The engineer may permit higher moisture. See *Standard Specification* 2-03.3(14)C for conditions.

** The engineer may permit thicker layers. See *Standard Specification* 2-03.3(14)C for conditions.

Bridge Approach Embankment

Bridge Approach Embankment definition is found in Section 1-01.3, and the compaction requirements are found in Section 2-03.3(14)I. One way to be aware of Bridge Approach Embankments is to draw them on the plans. Any test within this prism requires 95 percent density. Some project engineers plot all density tests on the plans. This is not necessary but could be of great value on certain projects.

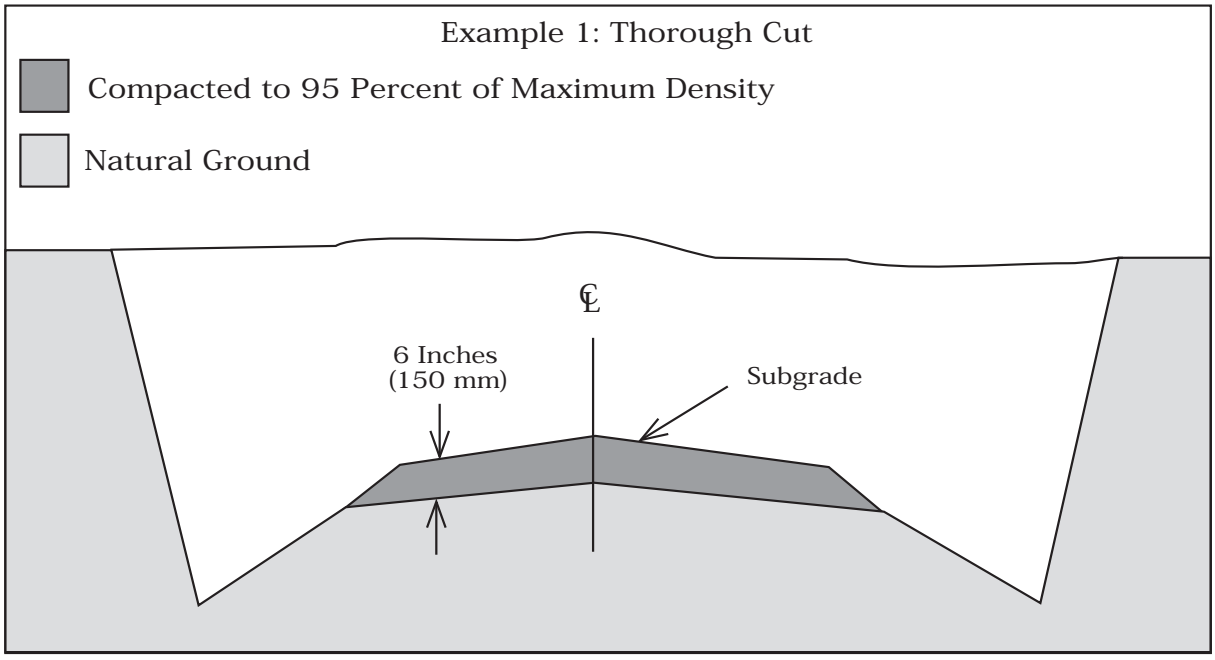
Subgrade Preparation

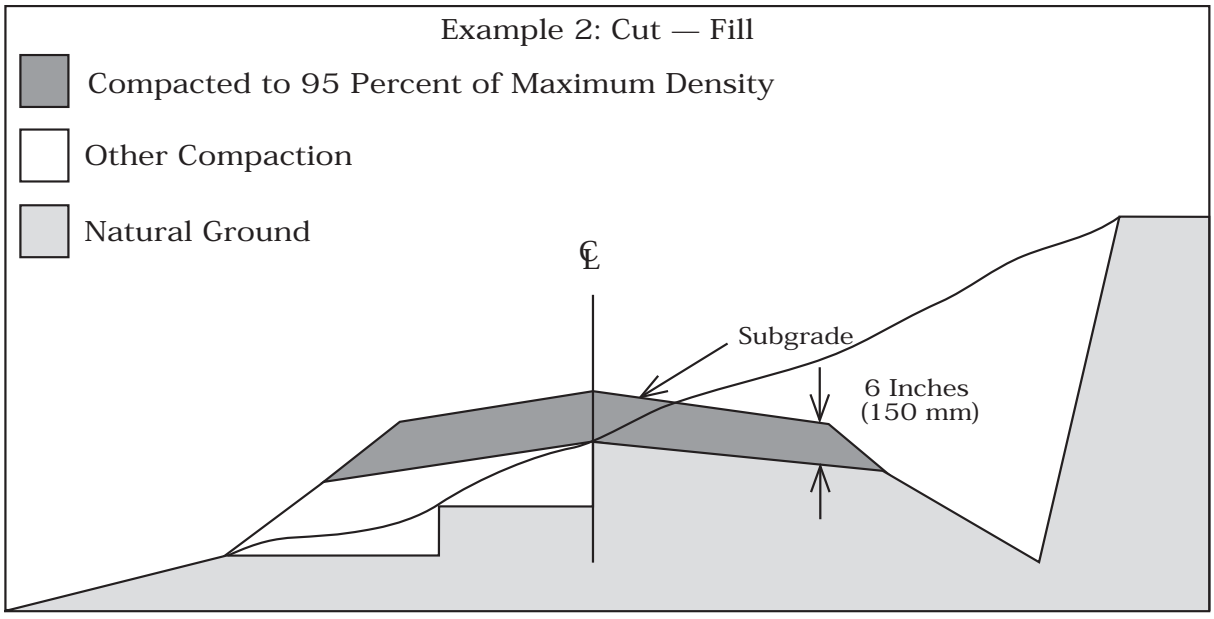
This work consists of preparing graded roadbed for surfacing or surfaced roadbed for paving.

Refer to Standard Specification 2-06 for construction requirements, measurement, and payment.

Subgrade Through Cut

Standard Specification 2-06.3(1)





Requirements

Item	Required	Std. Spec. Ref.
Application	Prepare the graded roadbed for surfacing.	2-06.3(1)
Compaction	95 percent - top 6 inches.	2-06.3(1)
Moisture	Less than 3 percent above optimum for materials passing U.S. No. 4 sieve (fill).	2-03.3(14)C
Lift Thicknesses	Does not apply.	
Test Frequency		9-5.7 (*Construction Manual*)

Other references: *Standard Specification* 2-06.3(2), *Standard Specification* 2-06.5(1), *Standard Specification* 2-06.5(2), *Construction Manual* 2-6.1, *Construction Manual* Chapter 9, WAQTC, WSDOT FOP AASHTO T-310.

Notes: If underlying subgrade is too soft to permit proper compaction of the upper 6 inches layer the contractor shall loosen, aerate (or excavate and remove), and compact the subgrade until the top layer can meet compaction requirements (*Standard Specification* 2-06.3(1)).

Wetland Construction

Construction per the contract plans !

- Erosion prevention is especially critical in wetlands and adjacent to wetlands, streams, and shorelines.
- Don't over-compact the bottom of wetland areas.

  Over-compaction in wetland areas will slow growth of vegetation. Soils may have to be loosened to help vegetation growth

- If water is encountered prior to reaching final elevation, notify your environmental section.

  Depending on the type of wetland being constructed, the final depth of water is critical. Wetlands may require deep water, to just saturated soil a few weeks out of the year.

  The time of year may effect the location of water table.

- Protect adjacent desirable vegetation using construction fencing.
- Slopes into wetlands should not be changed.
- Follow contouring plan.

  Small islands and shorelines with jetties are there to break up large water areas and to help vegetation growth and wildlife enhancement.

- Flag existing wetlands that are not to be disturbed by using construction fencing to keep construction equipment out of them.
- Consider installing wetland boundary signs. They are available from the Region's Environmental office or the OSC Environmental Affairs Office.

Other considerations during construction are outlined in Chapter 420 of the *Roadside Manual*.

Contour Grading

Landforms other than the roadway prism are usually represented using contours. Examples of such landforms include:

- Wetland mitigation sites
- Retention and detention ponds
- Noise abatement berms
- Interchanges

Contour grading accomplishes many things, such as:

- Directs water to a desired point
- Prevents erosion
- Provides noise deflection
- Provides visual fit of the facility into the landscape
- Protects desirable vegetation

Contour Grading Plans

Contour Grading Plans detail the blending of the constructed landform with the surrounding earth forms.

Plans to Field

The Grid Method or the Station and Offset Method are useful in transferring grading information from the plans to locations in the field.

Examples of the two methods are given in the construction section of Chapter 720 of the *Roadside Manual*.

Part 7

Surfacing Placement

Successful Surfacing Placement

Is a result of the following:

Using acceptable material

Placing the material on a properly prepared subgrade

Using the proper equipment in good working condition

Placing the material at the proper width, depth, and cross section

Compacting the material to the proper density

Surfacing Placement — Types

Gravel Base

Ballast

Crushed Surfacing

- Road Mix
- Plant Mix

Asphalt Treated Base

Check Aggregate Source

Review Request for Approval of Sources Form for all material to be used on the project

New Request for Approval of Sources Form must be submitted and approved prior to using any material from a new source

Aggregate testing completed and documented

- Submitted for density data

Visually inspect stockpiles for contamination

Arrange for Assistants/Communication

Notify supervisor of starting date and assistants needed:

- Scaleperson/Ticket Writer
- Ticket Receiver
- Density Inspector

Notify Independent Assurance Sampler

Establish and maintain good communication with all assistants, the independent assurance sampler, and the contractor

Scale Certification for Batching Scales

Copy of scale certification shall be in project records

Scales must be certified every time they are moved and then every six months

Sticker on scale face verifies these requirements

Lay Out

Stake stationing or mile posts as required

Check roadway cross sections

Check length of job and ensure plan quantities of aggregates are sufficient

Check drainage adjustments

Review miscellaneous details in plans

Truck Weights

Scale is checked several times a day and recorded on the Scaleman's Daily Report (WSDOT form 422-027) and example can be found in Appendix B)

- Balanced
- Returns to 0
- Operates within one half of one percent of the weighed load
- Everyday the scale is to be verified by weighing a loaded truck on a separate certified scale, unless the Project Engineer approves alternate method.

Tare trucks

- Morning and afternoon

Truck Measure (Volume)

When materials are measured and paid on the basis of volume of delivered trucks a receiver is assigned at the point of delivery to issue or receive load tickets and make periodic computations of yield.

The truck box of each vehicle will be measured, calculated and recorded to the nearest 0.1 cubic yard based on a leveled load. A sample Truck Measurement form can be found in Appendix B.

Delivery of Material to Project

Observe material in each truck as it arrives

Verify material is coming from correct stockpiles

Hauling equipment is routed to provide most effective compaction. It is usually best to spread the first course beginning at the point of loading, and each succeeding course beginning at the extreme end of the haul and proceeding toward the point of loading.

Hauling equipment not permitted over surfacing in process of construction

Placing the Material

Observe handling of material

- Gradation
- Segregation

Condition of subgrade examined during hauling — look for pumping

Section 4-04.3(4) lists the maximum compacted depths per course of different surfacing materials. Record the nominal depth for the different types of materials listed:

Ballast _____FT.

Gravel Base _____FT.

Crushed Surfacing _____FT.

Depth, Width, and Yield Checks

Checked frequently to avoid wasting material

Measure depth of each course and document for final records

Avoid overruns on top course to make up for deficiencies

Maximum depths for each course not exceeded

Density Testing

Vibratory compactors and rollers are to be used.

Each course compacted to 95 percent of standard density.

Representative samples of all surfacing material submitted to region Materials Lab, as early as possible, to allow for completion of the test.

Maximum density curve.

Test every 1,000 lineal feet of two-lane roadway.

Contractor informed of all density test results.

Check for uniform surface true to line and grade.

Surfacing Condition

Surfacing tolerances

Pumping grade

Quarter crown

Proper density

Correction of Deficiencies

Surface must be loosened

Deficient area and surrounding area recompacted

Weather Limitations

The *Standard Specifications* address the concern of weather limitations and the condition of the subgrade due to the weather. Be sure you are familiar with who makes the determination to place surfacing materials based on questionable weather.

Part 8

Compaction

General Information about Compaction

1. All operations must be directed toward constructing a uniform, well-compacted embankment true to grade and cross-section.
2. Proper compaction of roadway embankments and embankment slopes is of vital importance to the structural quality of the final roadway and strict adherence to specification requirements is essential.
3. In general, it can be stated that each soil has a maximum density to which it can be compacted with a given compactive effort.
4. Each different soil may, and probably will, have a different maximum density and optimum moisture content, and it is necessary that tests be performed in the field for each different soil encountered.
5. In selecting an area to be tested, the Inspector should choose sites where the least compactive effort has been applied.
6. Compaction is required to the neat lines of the embankment, which include the shoulders and slopes.
7. Daily compaction reports shall be submitted on Form 351-015.
8. Special attention shall be given to compaction around structures and bridge ends, where rollers cannot operate. Mechanical tampers or other approved compactors are to be used in these areas.

Control of Compaction of Granular Material

Use of the Maximum Density Curve

To acquire a maximum density curve, the engineer or inspector should submit 100 to 150 poundsof representative material as far in advance of contruction as possible. This sample is dried, graded, and divided into two fractions separated on the No. 4 sieve. Compaction tests and specific gravity tests are performed on the two fractions, and from that data, the -”Maximum Density vs. Percent Passing No. 4 sieve” curve is generated This curve is submitted to the field engineer for their control reference.

A specific curve must be used only for the material it represents. If more than one source is used to furnish aggregate, samples from each source should be submitted so separate curves can be established. If material from two different sources are blended to produce a single aggregate, a representative sample of the blended material must be submitted. If important changes in material occur within a given source, separate samples of the different materials must be submitted.

If the curve does not correlate satisfactorily with field results and compaction appears satisfactory, submit a representative sample from the roadway to the laboratory for a recheck. A new curve based on the roadway sample can be -obtained in about four days. (***Note:*** This will be necessary only when the original sample tested is not truly representative of the material placed on the roadway. Variations in gradation normally found will not void the use of the established curve.)

Washington State Department of Transportation
Materials Laboratory - Eastern
2714 North Mayfair Street, Spokane, WA 99207-2090

Miscellaneous Test Report — Fwd Roseburg Bannon 7-5-00

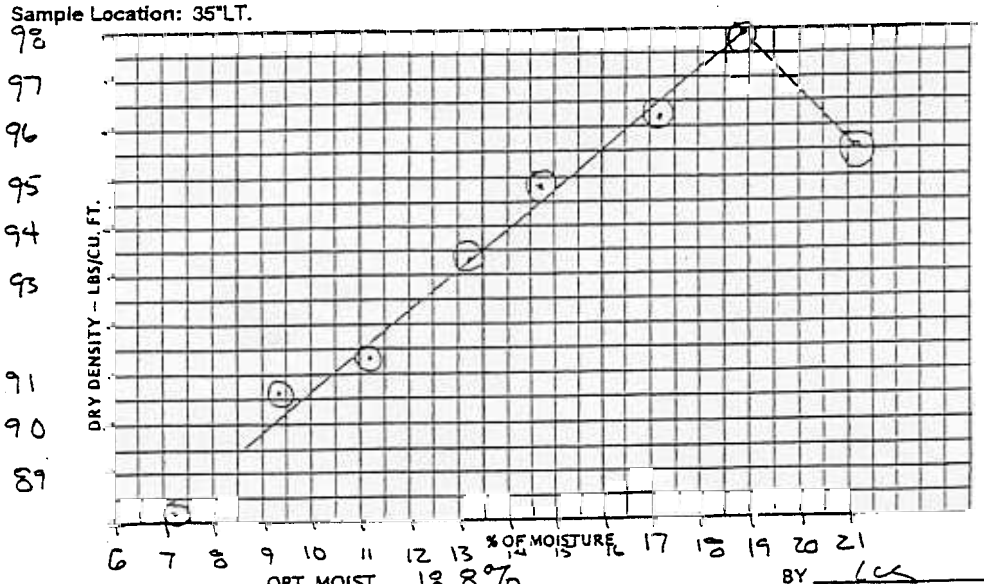
Date Received: 06/28/2000
State Route No: 020
County: OKANOGAN
Project Title: Bannon Creek to Aeneas Valley Road
Contractor:
Local Agency No:

Contract No: 005877
Lab Id No: 0000146030
Transmittal No: 337257
Bid Item No:
Org. Code: 424305
Federal Aid No:
Lab No:

Material: *Proctor*
Material Description: EMBANKMENT
Sub-Contractor:
Supplier Name:
Acceptance No:
Test Location: E.R.MAT LAB

Pit No:
Date Sampled: 06/01/2000
Date Received: 06/28/2000
Sampled By: J.GRAYBILL
IAS Sample No:
Tested By: DS

Sample Location: 35°LT.



OPT. MOIST. 18.8%
MAX. DENSITY 97.9 #/cf

BY LCS
DATE 7-5-00

Distribution
Project Engineer
X Terry Berends

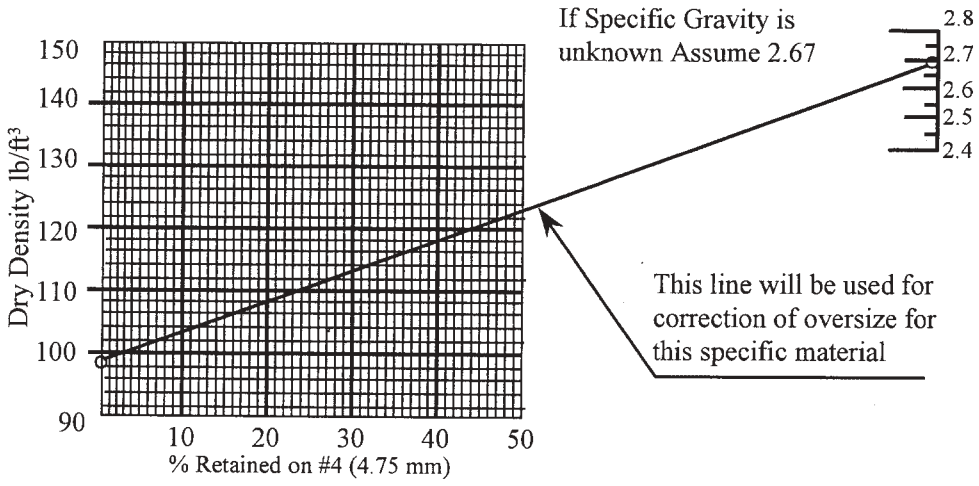
Result Code: Informational

Test Codes
T882 - 1

Thomas E. Baker, P.E.
State Materials Engineer
By:
Glen E. Gibson, P.E.
Region Materials Engineer

Date: 07/05/2000
Phone: (509) 324-6171

Nomograph for Oversize Correction



Max. Density from Report = 97.9

Specific Gravity of Material = 2.67 (assumed in this case)

Connect the Two Points

Washington State Department of Transportation

Field Density Test

Contract Number 6549 **SR Number** 405 **Date** 7/25/2003

Section Shady Meadows Rd. Vicinity **Inspector** I.M. Wonehappyperson

*** Test Hole Number**		BC-30		SG-15
Section to Section				
* Test Station		123+55		24+80
* Refererence to Centerline		2' RT		2'RT
* Refererence to Subgrade		+0.6		1.5'
* Material (Clay, Top Course, etc.)		CSBC		Silty-Sand
Depth of Material (If surfacing)		0.6'		N/A
Gauge Readings				
Dry Density lbs/cu ft	0	136.7		96.2
	90	134.5		95.5
Average Dry Density lbs/cu ft	Average	135.6		95.9
Moisture Content	0	6.3		16.4
	90	7.3		15.8
* Average Moisture Content	Average	6.8		16.1
Gradation Determination				
Mass of Sample + Tare		10.14		9.02
Mass of Tare		2.05		2.05
Mass of Sample		8.09		6.97
Mass Retained on No. 4 Sieve + Tare		6.04		3.06
Mass of Tare		2.05		2.05
Mass of Material Retained on No. 4 = Mass - Tare		3.99		1.01
% Retained on No. 4 Sieve (% Oversize) = Mass Retained (100) / Mass of Sample		49		14
% Passing No. 4 Sieve = 100 - % Retained		51		86
Specification Density Determination				
* Maximum Density from appropriate curve, lbs/cu ft		142.6		97.9
* Standard		D1-055-03		146030
* Corrected Maximum Density for Oversize, lbs/cu ft (non-granular material only)		N/A		103.7
* Density lbs/cu ft (% of maixmum) = Dry Density (100) / Maximum Density		95.1		92.5
Optimum Moisture Determination				
* Optimum Moisture (from curve)		8.30%		18.80%
* Opt. Moisture Corrected (non-granular mat. Only) =(Opt. Moisture)(% Passing No. 4)		N/A		16

Comments:

Note: If retest, add letter to number such as 1st test No. 27, retest 27A

*** Information is to be transferred to DOT Form 351-015, "Daily Comapction Test Report"**

Washington State
Department of Transportation

Maximum Density Curve

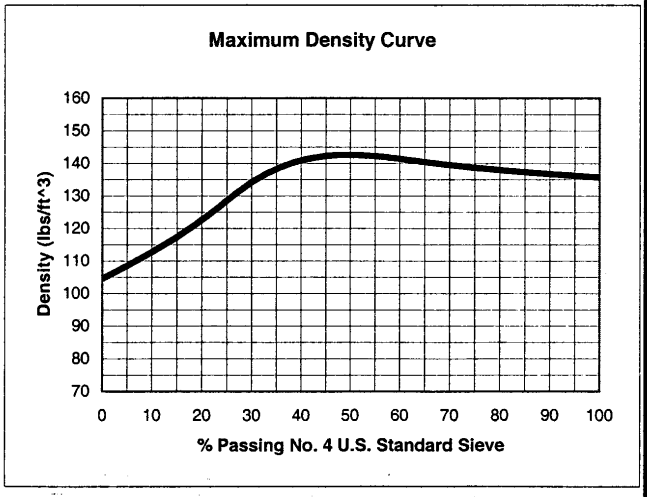
Barcode Number: 297127

Lab ID Number: D1-055-03

Sample Identification Data	
Contract Number:	6549
SR #:	405
Pit Number:	A 189
Section:	Bellevue Direct Access NE 4th St./Ne. 6th St.
Material Description:	CSBC
Project Engineer:	D. Becher
Date Received:	

Input Data	
Coarse Density (lbs/ft^3):	104.5
Fine Density (lbs/ft^3):	135.7
Fine Density (kg/m^3):	2.77
Fine Specific Gravity:	2.65

Results	
Passing #4 @ Maximum Density:	50.0
Maximum Density (lbs/ft^3):	**142.6**
Passing #4 @ Minimum Density:	0.0
Minimum Density (lbs/ft^3):	104.5
Percent Passing #4:	22.7
Approx. Opt. Moisture #4-0:	8.3
Corrected Optimum Moisture:	1.9
Corrected Optimum Moisture = (Approx. Opt. Moisture #4-0 X Percent Passing #4)/100	



Density Curves			
Pass #4	Maximum	Pass #4	Maximum
0.0	104.5	51.0	142.6
1.0	105.3	52.0	142.5
2.0	106.1	53.0	142.4
3.0	106.9	54.0	142.3
4.0	107.7	55.0	142.2
5.0	108.5	56.0	142.1
6.0	109.4	57.0	141.9
7.0	110.2	58.0	141.8
8.0	111.0	59.0	141.6
9.0	111.9	60.0	141.4
10.0	112.8	61.0	141.2
11.0	113.7	62.0	141.0
12.0	114.6	63.0	140.8
13.0	115.5	64.0	140.6
14.0	116.5	65.0	140.4
15.0	117.4	66.0	140.2
16.0	118.4	67.0	140.0
17.0	119.4	68.0	139.8
18.0	120.5	69.0	139.7
19.0	121.6	70.0	139.5
20.0	122.7	71.0	139.3
21.0	123.8	72.0	139.2
22.0	125.0	73.0	139.0
23.0	126.2	74.0	138.8
24.0	127.4	75.0	138.7
25.0	128.6	76.0	138.5
26.0	129.8	77.0	138.4
27.0	131.0	78.0	138.2
28.0	132.1	79.0	138.1
29.0	133.2	80.0	138.0
30.0	134.2	81.0	137.8
31.0	135.2	82.0	137.7
32.0	136.0	83.0	137.6
33.0	136.9	84.0	137.5
34.0	137.6	85.0	137.3
35.0	138.3	86.0	137.2
36.0	138.9	87.0	137.1
37.0	139.5	88.0	137.0
38.0	140.0	89.0	136.9
39.0	140.5	90.0	136.8
40.0	140.9	91.0	136.7
41.0	141.3	92.0	136.5
42.0	141.6	93.0	136.4
43.0	141.8	94.0	136.3
44.0	142.1	95.0	136.2
45.0	142.3	96.0	136.1
46.0	142.4	97.0	136.0
47.0	142.5	98.0	135.9
48.0	142.6	99.0	135.8
49.0	142.6	100.0	135.7
50.0	142.6		

For Classroom Use Only

MS Excel Version: September 2003

12/12/2003

Appendix A

References

2004 Edition

	Standard Specification 2004 Edition	Construction Manual
Clearing and Grubbing	2-01	2-1
Removal of Structures & Obstructions	2-02	2-2
Roadway Excavation and Embankment	2-03	2-3
Haul	2-04	2-4
Subgrade	2-06	2-6
Watering	2-07	2-7
Trimming and Cleanup	2-11	2-11
Construction Geotextile	2-12	2-12
Gravel Base	4-02	4-2
Ballast and Crushed Surfacing	4-04	4-4
Equipment	4-04.3(1)	
Mixing	4-04.3(3)	
Placing and Spreading	4-04.3(4)	
Nominal Depths of Compacted Material	4-04.3(4)	
Shaping and Compaction	4-04.3(5)	
Keystone	4-04.3(6)	
Weather Limitations	4-04.3(8)	
Hauling	4-04.3(9)	
Hours of Work	4-04.3(10)	
Shoulder Ballast	4-04.3(11)	
Guidelines for Job-Site Control of Materials		9-5
WSDOT Testing Methods		9-8

Appendix B

Forms

Washington State Department of Transportation

Inspectors TESC Field Checklist

Project Title	Contract No.	Date
Project Location/Region	**WSDOT Site Erosion Control Lead**	

Indicate whether or not the project is meeting the Minimum Requirements (if applicable) for erosion control. If the project is not meeting any Requirements, indicate the corrective actions required/taken.

	Yes	No
1. Stabilization and Sediment Trapping		
Are erodible soils stabilized? (Seed, mulch, erosion blankets, plastic, construction entrance, etc.)	☐	☐
Are sediment trapping BMPs (sediment traps, check dams, silt fences, etc.) in place?	☐	☐
2. Delineate Clearing and Easement Limits	Yes	No
Are the limits of clearing and grading clearly marked with barrier fencing?	☐	☐
3. Protection of Adjacent Properties (And Waters of the State)	Yes	No
Is there any stormwater leaving the site and does the discharge meet State Water Quality Standards?	☐	☐
Is sediment being deposited on adjacent properties or waterways?	☐	☐
If no, what is the turbidity of site discharge and of receiving water? _____		
4. Stabilization and Sediment Trapping	Yes	No
Are detention ponds installed to trap sediment from site runoff?	☐	☐
Are side slopes and outfalls of detention pond(s) stabilized?	☐	☐
5. Cut and Fill Slopes	Yes	No
Are exposed cut and/or fill slopes stabilized and protected from concentrated flows?	☐	☐
If there are groundwater seeps or springs, are the appropriate BMPs in place to dewater them (pipe slope drains, interceptor swales, dewatering wells)?	☐	☐
6. Controlling Off-Site Erosion	Yes	No
Is the site discharge contributing to offsite erosion?	☐	☐
7. Stabilization of Temporary Conveyance Channels and Outlets	Yes	No
Are temporary conveyance channels adequately stabilized?	☐	☐
Are conveyance channel outlets adequately stabilized?	☐	☐
8. Storm Drain Protection	Yes	No
Are all storm drains onsite being protected with functioning temporary inlet protection devices?	☐	☐
9. Underground Utility Construction	Yes	No
Are open utility trenches limited to 500 feet? (Puget Sound Basin Limitation)	☐	☐
Was the excavated material placed up gradient from the trench?	☐	☐
10. Dewatering	Yes	No
Is the groundwater treated in a way that optimizes overall site water quality?	☐	☐
11. Construction Access Routes	Yes	No
Is a stabilized construction entrance or wheel wash present and preventing trackout?	☐	☐

DOT Form 351-100 EF
Revised 4/03

12. Removal of Temporary BMPs	Yes	No
Is the groundwater treated in a way that optimizes overall site water quality?	☐	☐

13. Maintenance	Yes	No
Is the contractor completing weekly BMP inspection forms and keeping records?	☐	☐
Are BMPs adequately maintained?	☐	☐

Problems/Corrective Actions:

DOT Form 351-100 EF
Revised 4/03

Washington State
Department of Transportation

Scaleman's Daily Report

Contract No.	Date	Pit No.
Scale Location		
Materials Hauled		Item No.
State Scaleman Signature	Contractor's Scaleman Signature	

Morning Tare

Time	Truck No.	Tare

Afternoon Tare

Time	Truck No.	Tare

Remarks

Contractor's weighman operated the scales and the state inspector observed ( ) or
weighing operations were performed by the state inspector ( )

Scale Tested By (Company or Agency)	Date

The reverse side of this form must be used daily to document scale checking activity.

DOT Form 422-027 EF
Revised 9/02

Reference: Standard Specifications 1-09.2, Construction Manual Section 10-2.2

Everyday use one of the following three methods to determine if the scale is operating within one-half of one percent of the weighed load.

1. In accordance with 1-09.2(5), weigh a loaded truck on a separate certified platform scale designated by the contractor for the purpose of scale verification.

When approved by the Project Engineer:

2. Weigh your vehicle on a certified scale and check your scale with it.
3. If one truck is used for an extended period of time, use it as a "tattle-tale" check. The tare of the truck should be established just after the scale has been certified or checked by methods (1) or (2). When the truck is originally weighed, check the amount of fuel and make the daily check when the amount of fuel is the same, and check to see that the truck is free of mud, etc. This procedure is best utilized during dry weather. When this procedure is used, check the scales by methods (1),or (2) twice weekly.

Use this space to describe the check method and show the computations for the percent of variance. Use a separate sheet for each additional scale check.

Time of Scale Check _____ ☐ AM ☐ PM

Check Method Used ☐ Method 1 ☐ Method 2 ☐ Method 3

Vehicle Weight @ scale being used for project _____ (a)

Vehicle Weight @ independent scale _____ (b)

Weight Difference |a-b| _____ (c)

Difference (c) _____ Divided by weight of (a) _____ x 100 = _____ % of variance

Scale Variation > .5% refer to Standard Spec. 1-09.2(5)

Actions taken if out of tolerance:

_____

_____

_____

_____

_____

_____

In addition, periodic checks must be made throughout the day to see that the scale is balanced and returns to zero. If the scale does not return to zero, check for binding and/or clean the platform.

Time	Results	Time	Results

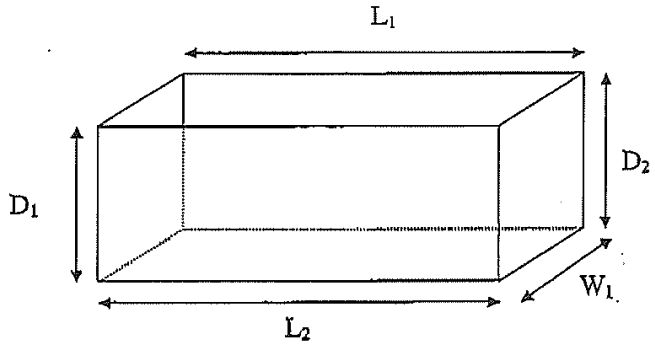
Abrupt stops by locking and holding brakes and large idling engines will affect the accuracy of the scales.

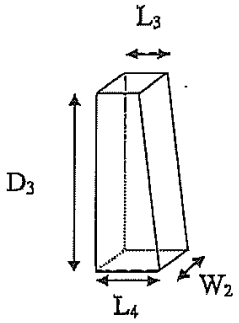
DOT Form 422-027 EF
Revised 9/02

TRUCK MEASUREMENT
(VOLUME)

CONTRACT NO _____ TRUCK NO _____

CONTRACTOR _____ MAKE/MODEL _____





LOAD CAPACITY (LC)

L_1 =
L_2 =
W_1 =
D_1 =
D_2 =
$((L_1+L_2)/2)xW_1x((D_1+D_2)/2)=$ (LC)

HOIST AREA (HV)

L_3 =
L_4 =
W_2 =
D_3 =
$((L_3+L_4)/2)xW_2xD_3=$ (HV)

LC - HV = _____ TOTAL CAPACITY CY

Rounded to nearest 0.1 CY = _____ MEASURED QUANTITY

Rounded to nearest 1 CY = [ ] PAY QUANTITY

Date measured: _____

Calculated by: _____

Checked by: _____

Refer to section 10-2.3A of the Construction Manual for addtional information regarding truck measurement

Appendix C

References to Highway Surveying Manual

Appendix C References to Highway Surveying Manual

	Chapter
Monuments (new and existing)	16
Clearing and Grubbing	15
Slope Staking	15
Grade Control	15

Appendix D

References to Highway Runoff Manual

Appendix D References to Highway Runoff Manual

	Chapter
Stormwater Site Plan	
Temporary Erosion and Sediment Control Plan (TESC)	5
Best Management Practices for Construction (BMPs)	Appendix 6A

Appendix E

References to Standard Plans

Appendix E References to Standard Plans

	Std. Plan
Slope Treatment	H-8
Embankment at Bridge Ends	H-9
Survey Stake	H-14

Appendix F

References to Roadside Manual

Appendix F References to Roadside Manual

	Chapter
Roadside Safety	310
Construction of Wetlands	420
Soil and Soil Amendments	700
Erosion Control	710
Contour Grading	720

Appendix G

Glossary

Angle of Repose — The angle between the horizontal and the maximum slope that a soil assumes through natural processes. For dry granular soils, the effect of the height of slope is negligible; for cohesive soils, the effect of height of slope is so great that the angle of repose is meaningless.

Borrow — Borrow is the excavation of material outside the roadway prism or outside the limits of any other excavation area required by the contract. This material is used in building embankments, subgrade, shoulders, and other highway components.

Boulders — A rock fragment, usually rounded by weathering or abrasion, with an average diameter of 12 inches (300 mm) or more.

Bridge Approach Embankments — An embankment beneath a structure and extending 100 feet (30 m) beyond a structure's end (at subgrade elevation for the full embankment width) plus an access ramp on a 10:1 (1:10) slope to the original ground elevation. Also, any embankment that replaces unsuitable foundation soil beneath the bridge approach embankment.

Bulking — The increase in volume of a material due to manipulation. Rock bulks upon being excavated; damp sand bulks if loosely deposited, as by dumping because the apparent cohesion prevents movement of the soil particles to form a reduced volume.

Caliche — Soil material which consists of layers of weathered deposits bonded by carbonates such as lime.

Clay (Clay Soil) — Fine-grained soil or the fine-grained portion of soil that can be made to exhibit plasticity (putty-like properties) within a range of water contents, and that exhibits considerable strength when air-dry. The term has been used to designate the percentage finer than 0.0002 mm (0.005 mm in some cases), but it is strongly recommended that this usage be discontinued, since there is ample evidence from an engineering standpoint that the properties described in the above definition are many times more important.

Clay Size — That portion of the soil finer than 0.002 mm (0.005 mm in some cases).

Cobble — A rock fragment, usually rounded or semirounded, with an average dimension between 3 and 12 inches (75 mm and 300 mm).

Cohesionless Soil — A soil that when unconfined has little or no strength when air-dried and that has little or no cohesion when submerged.

Cohesive Soil — A soil that when unconfined has considerable strength when air-dried and that has significant cohesion when submerged.

Compaction — The densification of a soil by means of mechanical manipulation.

Compaction Test — (Moisture-Density Test) A laboratory compacting procedure whereby a soil at a known water content is placed in a specified manner into a mold of given dimensions, subjected to a compactive effort of

controlled magnitude, and the resulting unit weight determined. The procedure is repeated for various water contents sufficient to establish a relation between water content and unit weight.

Compression — A volume change produced by application of a static external load.

Consolidation — A volume change that is achieved naturally with the passage of time.

Contract — The written agreement between the Contracting Agency and the Contractor.

Contractor — The individual, partnership, firm, corporation, or joint venture contracting with the Contracting Agency to do prescribed work.

Density — The weight of solids per unit volume. Dry density is calculated by dividing the weight of the solids by the volume of solids, water, and air.

Earth Embankment — The building up of soil material in layers to a specified cross section to support the roadway.

End Product Specification — A specification in which acceptance of the work is based on the finished product. This kind of specification allows the contractor to choose whatever method he chooses to achieve that end product. (See "Method Specification.")

Engineer — The Contracting Agency's representative who administers the construction program for the Contracting Agency.

Excavation — Removal of rock, soil, or other material from one location and hauling or moving it to another.

Fill — Man-made deposits of natural soils or rock products and waste materials.

Fines — Portion of a soil finer than a No. 200 (0.075 mm) sieve.

Frost Heave — The raising of a surface due to the accumulation of ice in the underlying soil or rock.

Glacial Till (Till) — Material deposited by glaciation, usually composed of a wide range of particle sizes, which has not been subjected to the sorting action of water.

Granular — Soil particles which do not have internal cohesive forces, but rather get their strength from friction.

Gravel — Rounded or semirounded particles of rock that will pass a 3 inch (75 mm) and be retained on a No. 4 (4.75 mm) sieve.

Gumbo — A material identified by a soapy or waxy appearance when wet.

Hardpan — A hard impervious layer, composed chiefly of clay, cemented by elatively insoluable materials, that does not become plastic when mixed with water and definitely limits the downward movement of water and roots.

Highway — A public way for vehicles, including the entire right of way.

Humus — A brown or black material formed by the partial decomposition of vegetable or animal matter; the organic portion of soil.

Inspector — The project engineer's representative who inspects contract performance in detail.

Loam — A mixture of sand, silt, or clay, or a combination of any of these, with organic matter (see humus). It is sometimes called topsoil in contrast to the subsoils that contain little or no organic matter. Loam is cohesive.

Loess — A uniform aeolian deposit of silty material having an open structure and relatively high cohesion due to cementation of clay or calcareous material at grain contacts. A characteristic of loess deposits is that they can stand with nearly vertical slopes.

Method Specification — A specification in which the manner in which the work is to be performed is specified. An example is the specification for compaction of rock embankments. This kind of specification implies that acceptance of the work will be based on how the work is performed regardless of what the end product is. (See also "End Product Specification.")

Moisture Content (Water Content) — The ratio, expressed as a percentage, of: (1) the weight of water in a given soil mass, to (2) the weight of solid particles.

Muck — Stone, dirt, debris, or useless material; or an organic soil of very soft consistency.

Optimum Moisture — The exact amount of water necessary to coat and lubricate each soil particle so the maximum density for any compaction effect may be obtained.

Organic Soil — Soil with a high organic content. In general, organic soils are very compressible and have poor load-sustaining properties.

Peat — A fibrous mass of organic matter in various stages of decomposition, generally dark brown to black in color and of spongy consistency.

Percent Compaction — This is the ratio of the actual in-place dry density of a soil to the maximum theoretical dry density.

Plasticity — The property of a soil or rock which allows it to be deformed beyond the point of recovery without cracking or appreciable volume change.

Project Engineer — The engineer's representative who directly supervises the engineering and administration of a construction project.

Roadbed — The graded part of the highway within top and side slopes, prepared as a foundation for the pavement structure and shoulders.

Roadway — The portion of the right of way within the outside limits of the side slopes.

Roadway Excavation — All materials excavated within the roadway prism, side borrow areas, and side ditches.

Rock — Natural solid mineral matter occurring in large masses or fragments.

Rock Embankment — An embankment in which all or any part of an embankment contains 25 percent or more by volume, gravel or stone 4 inches (100 mm) or more in diameter.

Sand — Particles of rock that will pass the No. 4 (4.75 mm) sieve and be retained on the No. 200 (0.075 mm) sieve.

Shoulder — The part of the roadway next to the traveled way. It provides lateral support of base and surface courses and is an emergency stopping area for vehicles.

Silt — (Rock Flour) Material passing the No. 200 (0.075 mm) sieve that is nonplastic or very slightly plastic and that exhibits little or no strength when air-dried.

Silt Size — That portion of the soil finer than 0.02 mm and coarser than 0.002 mm (0.05 mm and 0.005 mm in some cases).

Sluicing — A method of excavation by which material is moved by flushing with water.

Soil — (Earth) Sediments or other unconsolidated accumulations of solid particles produced by the physical and chemical disintegration or rocks, and which may or may not contain organic matter.

Soil Binder — That portion of soil passing the U.S. No. 40 (0.425 mm) sieve.

Stone — Crushed or naturally angular particles of rock that will pass a 3 inch (75 mm) sieve and be retained on a No. 4 U.S. standard (4.75 mm) sieve.

Structure Excavation — Excavating and disposing of all natural material or manmade objects that must be removed to make way for bridge foundations, retaining walls, culverts, trenches for pipelines, conduits, and other structures as shown in the Plans.

Structures — Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, endwalls, buildings, service pipes, sewers, underdrains, foundation drains, and other features found during work that the contract may or may not classify as a structure.

Subcontractor — An individual, partnership, firm, corporation, or joint venture who is sublet part of the contract by the contractor.

Subgrade — That part of the roadbed on which subbase, base, surfacing, pavement, or layers of similar materials are placed.

Surcharge — Applied overload above grade of compacted soil to produce settlement in unstable subsurface materials. Loading is applied until measured settlement has subsided and removal of overload can take place.

Surfacing — One or more courses of crushed stone placed upon prepared subgrade in accordance with the specifications.

Talus — Rock fragments mixed with soil at the foot of a natural slope from which they have been separated.

Topsoil — Surface soil, usually containing organic matter.

Traveled Way — The part of the road made for vehicle travel excluding shoulders and auxiliary lanes.

U.S. Standard No. 4 (4.75 mm) Sieve — This is the sieve used to calculate the "percent passing the No. 4 (4.75 mm) sieve" for use with a maximum density curve, and to calculate the "percent retained on the No. 4 (4.75 mm) sieve" for use with the "Nomograph" curve. A U.S. Standard No. 4 (4.75 mm) sieve is not the same as a 1/4 inch (6.3 mm) sieve, nor is it the same as a Tyler No. 4 sieve.

U.S. Standard No. 4	= .187↑	opening
U.S. Standard 1/4 inch	= .250↑	opening
Tyler No. 4	= .1	opening

Waste — Surplus excavation not needed for embankment.

Wet Density — The weight of solids and water per unit volume. Wet density is calculated by dividing the weight of solids and water by the volume of solids, water, and air.

Soil Componet Discriptions

Prior to trench excavation work, you should review the test boring logs for your contract and become familiar with the information and what you should expect to see during excavation. The following table of terms that are commonly used to describe soil components on the boring logs.

Componets	Discription
Sand	Discribes a sample that consist of both fine and coarse sand particals.
Gravel	Describes a sample that consists of both fine and coarse gravel particals.
Silty Fine	Major component fine sand, with non-plastic fines.
Sandy Gravel	Major component gravel size, with fine and coarse sand. May contain small amount of fines.
Gravelly Sand	Major component sand, with gravel. May contain small amount of fines.
Gravelly Sand, Silty	Major component sand, with graveland non-plastic fines.
Gravelly Sand, Clayey	Major component sand, with gravel and plastic fines.
Sandy Gravel, Silty	Major component gravel size, with sand and plastic fines.
Sandy Gravel	Major component gravel size, with non-plastic fine. May contain sand.
Clayey Gravel	Major component gravel size, with plastic fines. May contain sand and silt.
Clayey Silt	Major component silt size, with sufficient clay to impart plasticity and consider strength when dry.
Silty Clay	Major component clay, with silt size. Higher degree of plasticity and higher dry strength than clayey silt.

Soil	Visual	Moist Sample	Soil ribboned between thumb and finger when moist.
Sand	Individual grain size is detectable. It is free flowing when dry.	Forms a cast that crumbles when lightly touched.	Cannot be ribboned.
Sandy Loam	Granular soil with sufficient silt and clay to make it somewhat coherent. Sand predominates.	Forms cast that not break with careful handling.	Cannot be ribboned.
Loam	Uniform mixture of sand, silt and clay. Gritty feel but is fairly smooth and slightly plastic.	Forms a cast that can be handled without breaking.	Cannot be ribboned
Silt Loam	Has a moderate amount of finer grades of sand, small amount of clay and over half the particles are silt. When dry may appear Cloddy which can be broken And pulverized into powder.	Forms a cast that can be handled. When wet soil runs together and puddles.	Will ribbon but has broken Appearance and feels smooth. Maybe slightly plastic.
Silt	Contains over 80% of silt particles with very little sand and clay. when dry it maybe cloddy, readily pulverizes to power with a flour like feel.	Forms a cast that can be handled. When wet it puddles.	Tendency to ribbon with Broken appearance and feels smooth.
Clay Loam	Fine textured soil breaks into hard lumps when dry. Contains more clay than silt loam. Looks like clay in dry form. Identify by physical behavior when moist.	Forms cast that can be handled without breaking. Can be worked into a dense mass.	Forms a thin ribbon which breaks easily. Barely sustains its own weight.
Clay	Fine textured soil breaks into hard lumps when dry. Difficult to pulverize into flourlike powder. Identify by physical behavior when moist.	Forms cast that can be handled without breaking.	Forms long thin flexible ribbon. Can be worked into a dense compact mass. extremely plasticity.